

Missouri Duck Season Date and Zone Boundary Review



Weather, Migration, and Harvest Data for Missouri

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Introduction

The Missouri Department of Conservation (Department) is seeking public input regarding duck zone boundaries, the choice between continuous versus split seasons and season date formulas. The opportunity to change duck season structure (continuous or split seasons and zone boundaries) is available to states about every five years. The U.S. Fish and Wildlife Service (FWS) will allow states to submit zone boundary and continuous versus split season recommendations by July 1, 2020 for the 2021-2025 duck seasons. The zone options selected for 2021-2025 must remain in place even if the duck season is shortened to 45 or 30 days. Duck season structure options for 2021-2025 include the following:

- A statewide season with no zones or splits
- Four zones and no splits
- Three zones with potential for one split (two open segments) in each zone
- Two zones with potential for two splits (three open segments) in each zone

The Department will also be reviewing the duck season date formulas that have been in place since 2017 and will adjust as needed for the 2021-2025 duck seasons. Hunting conditions can vary tremendously from one year to the next. During some years, the best hunting can occur early in the season; during other years, it can occur late. Limiting changes to about every five years helps the Department evaluate the effectiveness of zone boundaries and season dates over a range of conditions.

Hunter input is an essential part of the equation for establishing duck season dates and zone boundaries. The Department will use a web-based survey made available to Missouri migratory bird hunters in December 2019 and January 2020 to capture a broad range of duck hunter perspectives regarding Missouri's duck season structure. In addition, the Department is hosting a series of workshops during late January, February and early March 2020. The purpose of the workshops is to share information used to develop hunting season recommendations and to provide hunters a chance to offer their views about season dates, zone boundaries and continuous vs split seasons for the 2021-2025 seasons.

This report provides weather, migration, and harvest data to assist hunters when developing their recommendations for zone boundaries, a continuous versus a split season and season date formulas for 60-day, 45-day and 30-day seasons. Data are compiled to depict information from statewide, zone and regional perspectives.

Missouri Duck Season Structure Objectives and Guiding Principles

Objective

To establish zone boundaries and season dates that best accommodate hunter preferences, including those of hunters with varying levels of experience and those who hunt in different types of habitat (e.g., shallow water versus rivers and reservoirs), target different species (e.g., mallards versus early-season migrants), have varying physical capabilities (e.g. tolerance for cold and ice), and employ different hunting styles (e.g., water versus field hunting).

Given the range of hunter preferences, it is likely that not all hunters will be completely satisfied regardless of which season dates or zone boundaries are selected. The challenge is to provide a balance that will accommodate at least a portion of most hunters' desires. The choice of duck season structure and season dates has little impact on the overall status of duck populations. As a result, biological considerations are not as critical as providing duck seasons that contribute to overall quality hunting experiences. The FWS uses an Adaptive Harvest Management approach to determine if the season will be 60 days, 45 days, or 30 days in length and if the overall bag limit will be six ducks or three ducks. The combination of season length and bag limits is determined by the size of duck populations and habitat on the breeding grounds. States can select opening and closing dates between the Saturday nearest September 24 and January 31.

Guiding Principles

1. Current duck season options must consider the possibilities for 30-day, 45-day, and 60-day seasons. We have experienced nearly unprecedented opportunity with 60-day seasons since 1997. There is no guarantee that this will continue and potential season lengths of 30 and 45 days are possibilities that must be considered as changes in season structure are contemplated.
2. Duck season dates and zone boundaries will be recommended to accommodate a range of hunting styles and preferences. All hunter preferences are legitimate. Dates that completely favor one group will likely disenfranchise another and may not accommodate the range of hunting styles throughout a region.
3. Duck season date and zone boundary selections will seek to balance providing opportunities for new hunters and satisfying more avid hunters. Over the past two decades, duck hunter numbers have declined across the country, but have remained relatively stable in Missouri. The Department will continue to consider the implications of season structure for recruiting new hunters as well as for retaining existing hunters.
4. Duck season dates for each zone must balance the hunter preferences from different regions within each zone.
5. Duck zone boundaries will be based upon the preferred season dates for hunters throughout a region. Boundaries will not be designed to accommodate a particular area or ownership, whether it is public or private.
6. The purpose of duck zones is to provide the "best" season dates for a particular region, not to extend the season for hunters who travel from zone to zone to extend their hunting season.

7. Recommendations for 2021-2025 will depend primarily upon hunters' input. If most hunters from a particular region prefer a different season structure (zones and splits) or season dates, a change will likely be recommended. Otherwise, "change for the sake of change" will not be recommended. Regardless, the time and effort taken by hunters to provide their input is valued and it will help us develop the best possible recommendation for Missouri duck hunters.

Duck Season Data for Missouri

In the pages that follow, we first summarize weather, migration, and harvest data at the zone level and then by 14 regions within Missouri (Figure 1). The zone-wide section provides a broad overview. Data summarized by region are intended to serve as a reference as hunters contemplate what season dates and zone boundaries they think would be best in the regions they hunt most often. It also illustrates regional differences within zones that will need to be accommodated when season dates are set and zone boundaries established. Long-term weather data helps predict when regions of the state can expect weather that will likely result in the arrival or departure of ducks. Waterfowl counts from state and federal refuges show when ducks typically are most abundant in Missouri and harvest data reveals when hunters harvest the most ducks.



Figure 1. Regions of Missouri 2021-2025 duck season structure review.

Weather Data

1) Dates when temperatures will likely fall below 24° Fahrenheit and 16° Fahrenheit.

For most duck hunters, a key question is when they can expect wetlands and lakes to freeze-up. A temperature that causes “freeze-up” cannot be specifically defined. Size of the water body, water depth, vegetation, wind protection, flowing water, and other factors all have a bearing on whether or not a particular body of water freezes over at a certain temperature. We selected daily low temperatures of 24°F and 16°F to represent the relative risk of freeze-up to hunters in various habitats. A low temperature of 24°F likely coincides with initial ice formation on shallow water areas and the likely arrival of mallards in reasonable numbers. A low temperature of 16°F represents the risk of more severe ice conditions. The Missouri Climate Center Information provided the data and it originated from weather stations that correspond to the 14 regions used to summarize population, migration and harvest data.

2) The percentage of years Department intensively managed wetland areas had ice two or more inches thick during two periods: 2007-2016 and 2017-2018.

When ice is two or more inches thick on Department intensively managed wetlands, it suggests that most wetlands are unavailable for hunting without the aid of ice eaters or pumping water. When this occurs hunting is primarily limited to rivers, reservoirs, and fields. Duck numbers often decline once these ice conditions become prevalent. These data were provided by Department wetland managers who record ice conditions on their respective conservation areas each day of the hunting season.

3) Average fall temperatures from 1895 through 2018.

One of the greatest unknowns is what weather patterns will be like in the future and how they will influence duck migrations. Is the climate getting warmer? Will it be warmer in the next five years than it was in the past five years? Average temperatures from November through January across more than 100 years provide insights about cyclical cooling and warming trends and what we may expect in terms of annual variation in weather. At the state level, these data were provided by Dr. Patrick Guinan, the Missouri state climatologist, from the Missouri Climate Center at the University of Missouri-Columbia.

Migration Data

1) A comparison of migration timing during the most recent five years (2014-2018) to the previous twenty years (1994-2013).

Corresponding to uncertainty about weather patterns, hunters and waterfowl biologist alike are beginning to raise questions about the timing of migration. Are ducks arriving in Missouri later than in the past? Are they staying longer? Fortunately, Missouri has one of the longest-running datasets of weekly waterfowl numbers in the country that dates back to the early 1950s. In this report, we provide comparisons at the regional level using data from the most recent five years (2014-2018) and the previous 20 years (1994-2013) to illustrate how recent experiences compare to the past. At the zone level, we provide information using data from the last 10 years (2009-

2018). By using this shortened time frame, we were able to include data from more areas. These data are the result of at least biweekly surveys on state and federal wetland areas. The data are reported as the percent of the fall/winter duck use that occurred by week. For some areas that have been acquired or developed more recently (e.g., Nodaway Valley CA or Ten Mile Pond CA), the population data may be less than the 20 years usually available. In other instances (e.g., southern Missouri), no managed state or federal wetland area exists in the region; in these instances, no population data are presented.

2) A comparison of migration timing of mallards versus other species of dabbling ducks.

Hunter season date preferences depend, in part, on which species of ducks they tend to hunt. Species such as pintails, green-winged teal, gadwall, wigeon, and shovelers tend to arrive earlier than mallards. Based on data from the last 25 years (1994-2018), this report provides comparisons of the timing of migration of mallards versus other species of dabbling ducks. The data are reported as the percent of the fall/winter duck use that occurred by week for mallards versus other species of dabbling ducks.

Harvest Data

1) Average daily harvest per week on public and private land for all duck species combined.

Each year the FWS asks a sample of hunters to record harvest from each of their hunting trips and a smaller sample to submit a wing from each of the ducks they harvested. These data are used to estimate the size and species composition of the harvest. Although the sample sizes for particular regions can be small and result in imprecise estimates, we have combined data from two periods: 2011-2016 and 2017-2018. These comparisons provide clues about the distribution of harvest across regions in Missouri throughout the fall and whether this distribution has shifted since changes in season date formulas and zone lines were implemented in 2017. Harvest reported from opening weekends and the first day of the second segment in the case of split seasons are excluded from analysis. Larger numbers of birds are typically harvested on opening weekend regardless of the timing of the opener. We observed a similar pattern on the first day after the split in Middle and South Zones. The split season essentially resulted in a “second opener.” By excluding birds harvested on “openers”, the results should better reflect changes in harvest based on the time of season. These estimates are more precise in areas with larger sample sizes. Data are summarized so each month consists of 4 periods of approximately 8 days each. To account for differences in the number of days in a week when a season is open, the daily average per week is reported. For example, the 4th period in October may only have 1 or 2 days if the season does not open until the last weekend in October. We then calculated the percent each week contributed to the yearly total and then took the average percent across years. This approach provides a general perspective of how much the average daily harvest each week contributes to the overall harvest.

2) Average daily harvest per week on public lands of all ducks based on harvest estimates from Missouri Department of Conservation (MDC) intensively managed wetlands areas within a region.

Missouri Department of Conservation wetland area managers record the number of hunters and their harvest each day. We took a similar approach with harvest on MDC intensively managed

wetlands as we did with FWS harvest estimates. We combined data from two periods: 2011-2016 and 2017-2018 and excluded harvest from opening weekends and the first day of the second segment in the Middle and South Zones. Data are summarized so each month consists of 4 periods of approximately 8 days each. To account for differences in the number of days in a week when a season is open, the daily average per week is reported. For example, the 4th period in October may only have 1 or 2 days if the season does not open until the last weekend in October. We then calculated the percent each week contributed to the yearly total and then took the average percent across years. In some instances, the analysis may exclude Conservation Areas when data were not available. In regions that do not have a Conservation Area, no area harvest data are presented.

3) Average daily harvest per week on public lands, excluding opening weekends, of mallards and other ducks based on harvest estimates from MDC's intensively managed wetlands within a region.

This analysis is based on the same database used to calculate average daily harvest from public lands within a region of all duck species per week. It provides perspectives of the timing of mallard harvest and other species of ducks. To illustrate differences in timing of mallards and other species of ducks, we used data from 2011-2016.

4) Average daily mallard band recoveries, excluding opening weekends.

Mallard band recovery data provide another source of information about harvest distribution on public and private land by location and date. More mallards are banded each year than other species. Not enough birds are banded and recovered in Missouri for species other than mallards to get an adequate representation of the timing of harvest. As a result, this report only includes mallard band recoveries from mallards that were banded north of Missouri during the months of July through September. The band recovery data are summarized in a similar fashion as the harvest data. Recoveries from opening weekends are excluded and the data are presented as the percent the daily average per week contributes to the yearly total.

History of Duck Zones and Season Dates in Missouri

Zone Boundaries

Zones were first employed in Missouri for the 1977-78 and 1978-79 seasons with the state divided into a North and South Zone. Seasons in the North Zone were timed about three weeks earlier than South Zone seasons (Figure 2, Pages 7-9. shows zone configurations and Table 1, Pages 10-11 lists historical season dates).

In 1991, following more than a decade of annual proposals from states for split season and zone boundary changes, the FWS developed criteria to limit the season structure options and to limit the frequency of change to 5-year intervals. The limited split season/zone options included: 1) a statewide season with no zones or splits, 2) a statewide split season with no more than three segments and no zones, 3) two zones with an option of a split season with no more than two segments in either or both zones, or 4) three zones with no splits. In 2012, the FWS offered states two new options, four zones with no splits or three zones with split seasons. In 2019, the FWS added the option of two zones that each could include two splits and three segments.

Figure 2. Missouri Duck Zones (before 1977 through 2020)

Missouri Duck Zones, Prior to 1977



Missouri Duck Zones, 1977-79



Missouri Duck Zones, 1980-85



Missouri Duck Zones, 1986-90**Missouri Duck Zones, 1991-2000****Missouri Duck Zones, 2001-2005**

Missouri Duck Zones, 2006-2010**Missouri Duck Zones, 2011-2016****Missouri Duck Zones, 2017-2020**

Table 1. Season dates and bag limits from 1960 through 2019.

Season	Days	Bag Limit	Statewide	North Zone	Middle Zone	South Zone
1962	25	2	11/2-11/26			
1963	35	4	10/25-11/28			
1964	40	4	10/30-12/8			
1965	40	4	10/29-12/7			
1966	45	4	11/1-12/15			
1967	40	4	11/1-12/10			
1968	30	3	11/1-11/30			
1969	30	4	11/1-11/30			
1970	55	6	10/24-12/17			
1971	50	4	10/31-12/19			
1972	50	4	10/29-12/17			
1973	45	7	11/1-12/15			
1974	50	7	10/30-12/18			
1975	50	7	10/29-12/17			
1976	50	10	10/26-12/5 & 12/26-1/3			
1977	45	10		10/25-12/8		11/15-12/29
1978	50	10		10/24-12/12		11/14-1/2
1979	50	10		10/24-12/12		11/14-1/2
1980	50	10		10/18-10/22 & 11/1-12/15		11/1-12/15 & 12/26-12/30
1981	50	10		10/17-10/21 & 10/31-12/14		10/31-12/14 & 12/26-12/30
1982	50	10		10/16-10/20 & 10/30-12/13		10/30-12/13 & 1/8-1/12
1983	50	10		10/15-10/19 & 11/1-12/15		11/1-12/4 & 12/17-1/1
1984	50	10		10/20-24 & 11/1-12/15		11/1-12/2 & 12/15-1/1
1985	40	5		10/19-10/21 & 11/2-12/8		11/2-12/1 & 12/27-1/5
1986	40	5		11/1-12/10		11/22-12/14 & 12/27-1/12
1987	40	5		10/31-12/9		11/21-12/13 & 12/26-1/11
1988	30	3		11/5-12/4		11/19-12/4 & 12/26-1/8
1989	30	3		11/4-12/3		11/18-12/4 & 12/26-1/7
1990	30	3		11/3-12/2		11/17-12/4 & 12/26-1/6
1991	30	3		11/2-12/1	11/9-12/8	11/30-12/29
1992	30	3		10/31-11/29	11/7-12/6	11/28-12/27
1993	30	3		10/30-11/28	11/6-12/5	11/27-12/26
1994	40	3		10/29-12/7	11/5-12/14	11/25-1/3
1995	50	5		10/28-12/16	11/4-12/23	11/22-1/10
1996	50	5		10/26-12/14	11/2-12/21	11/23-1/11
1997	60	6		10/23-12/21	10/30-12/28	11/13-1/11

Season	Days	Bag Limit	Statewide	North Zone	Middle Zone	South Zone
1998	60	6		10/22-12/20	10/29-12/27	11/12-1/10
1999	60	6		10/23-12/21	10/30-12/28	11/13-1/11
2000	60	6		10/26-12/24	11/2-12/31	11/16-1/14
2001	60	6		10/27-12/25	11/3-1/1	11/22-1/20
2002	60	6		10/26-12/24	11/2-12/31	11/23-1/21
2003	60	6		10/25-12/23	11/1-12/30	11/22-1/20
2004	60	6		10/30-12/28	11/6-1/4	11/26-1/24
2005	60	6		10/29-12/27	11/5-1/3	11/25-1/23
2006	60	6		10/28-12/26	11/4-1/2	11/24-1/22
2007	60	6		10/27-12/25	11/3-1/1	11/23-1/21
2008	60	6		10/25-12/23	11/1-12/30	11/27-1/25
2009	60	6		10/31-12/29	11/7-1/5	11/26-1/24
2010	60	6		10/30-12/28	11/6-1/4	11/25-1/23
2011	60	6		10/29-12/27	11/5-1/3	11/24-1/22
2012	60	6		10/27-12/25	11/3-1/1	11/22-1/20
2013	60	6		10/26-12/24	11/2-12/31	11/28-1/26
2014	60	6		10/25-12/23	11/1-12/30	11/27-1/25
2015	60	6		10/31-12/29	11/7-1/5	11/26-1/24
2016	60	6		10/29-12/27	11/5-1/3	11/24-1/22
2017	60	6		11/4-1/2	11/4-10 & 11/16-1/7	11/23-26 & 12/4-1/28
2018	60	6		11/3-1/1	11/3-9 & 11/15-1/6	11/22-25 & 12/2-1/27
2019	60	6		11/2-12/31	11/9-15 & 11/21-1/12	11/28-12/1 & 12/7-1/31

Missouri has included three zones 1991-2018, but MDC has made several adjustments to zone boundaries. The 2001-2005 review resulted in an adjustment to the North/Middle Zone boundary to include portions of Lincoln, Warren, and St. Charles counties in the Middle Zone and the Middle/South Zone boundary was modified to include Barton, northern Jasper and southern Vernon counties in the South Zone. The 2006-2010 season review resulted in the North/Middle zone boundary in western Missouri shifting north from Hwy 54 and Hwy 50 to I-70 to accommodate the desire for later hunting opportunity in this region. The 2011-2015 season structure review resulted in the Middle/South boundary line in western Missouri being modified to return to a location similar to the 1991-2000 boundary with the exception that it left a greater portion of Barton County in the South Zone. Additionally, the Middle/South Zone boundary in southeast Missouri was moved from I-55 west to Hwy 25 to accommodate a desire for later season dates that more closely aligned with timing of duck movements and habitat use in this portion of the state. The 2016-2020 season structure review saw a return of the Middle/South Zone boundary to the location it occupied from 2011-2015 and an adjustment north to the western portion of the North/Middle Zone boundary which shifted much of the Missouri River floodplain in that part of the state into the Middle Zone, thus, accommodating a desire for later season dates expressed by Missouri River hunters. Each of the resulting zone boundaries represented a compromise between regions and among hunters within regions based on different habitats, different species hunted, and different hunting styles.

Continuous versus Split Seasons

Missouri had its first experience with a split season in 1976. At the time, there were no zones and the statewide season included a 41-day segment (Oct. 26-Dec. 5) followed three weeks later by a nine-day segment (Dec. 26-Jan. 3). The split was designed to provide late season opportunity that had not been available during most years. The following year, Missouri returned to a continuous season, but divided the state into two zones. The option to have a split season in two zones was first offered in 1980 and used in Missouri from 1980-1985. During 1980-82, a 5-day early segment in the North Zone and a 5-day late segment in the South Zone complemented a statewide segment of 45 days. An early segment of 3-5 days was retained in the North Zone during 1983-85 (40 to 50-day seasons), while the late segment in the South Zone was expanded to 10-18 days. The North Zone returned to a continuous season of 30-40 days during 1986-90, whereas the South Zone retained a split season that included an early segment of 16-23 days and a late segment of 12-17 days. In 1991, based upon hunter input and preferences, Missouri opted to take the new option of three-zones with no split seasons rather than maintaining two zones with a split. By the 2016-2020 open season, however, hunter consensus had coalesced around a desire for later season dates and strong interest in using the new option of three zones with a split to achieve this objective. The 2017-2020 seasons include a split in the Middle and South Zones although the North Zone retained a continuous season structure. The Middle Zone opens for a 7-day segment, closes for a 5-day split, and then reopens a second 53-day segment. The South Zone season is structured with an opening 4-day segment occurring over the Thanksgiving Day holiday weekend followed by a split of sufficient length to ensure the second segment runs to January 31 which is as late as the federal framework allows.

Season Dates

Season dates have gradually shifted later. In the early 1960s, when hunters experienced seasons of 25 and 35 days, the statewide season opened either in late October or early November and closed by the end of November. In 1975, the last year without zones, the statewide season closed on December 17th, over a month earlier than when it now closes in the South Zone. Up until the mid-1990s, the North Zone closed by mid-December, in part due to shorter seasons. The Middle Zone closing date in the 1990s ranged from December 5 in 1993 to December 28 in 1999. In the South zone closing dates ranged from December 26 in 1993 to January 11 in 1999. Beginning in 2001, South Zone dates were shifted about a week later and North and Middle Zone dates followed suit in 2004.

Prior to 2011, the Department adjusted waterfowl season dates each year. During the 2011 duck season structure review, the Department sought input about establishing a season date formula that would remain in place for a number of years. This option would not leave hunters guessing from one year to the next what the season dates would be in the event of 60, 45, and 30-day seasons. It also provided a much more realistic timeframe to evaluate hunter opinions of season dates under a greater range of conditions than is possible after just one year. Hunters were supportive of this change and the first duck season date formulas were implemented in 2011 (Table 2). These formulas maintain opening dates associated with a specific weekend of the month, or holiday as was the case in the South Zone. As a result, season dates can vary by seven days within a six-year period. This variation in dates accommodates those with earlier or later season preferences over an extended period of time.

Table 2. Season date formulas for the North, Middle and South Zone, 2011-2016.

	60-day Season	45-day Season	30-day Season
North Zone	Last Sat. in October	First Sat. in November	Second Sat. in November
Middle Zone	First Sat. in November	Second Sat. in November	Third Sat. in November
South Zone	Thanksgiving Day	First Sat. in December	Second Sat. in December

By the 2016-2020 open season, hunter consensus had coalesced around a desire for later season dates and strong interest in using a split to achieve this objective. The season date formulas implemented after the 2017-2020 season structure review reflect this desire for later season dates expressed by waterfowl hunters in the statewide survey and workshops (Table 3). Specific season date considerations and potential impacts of each recommended season date formula by zone are described below.

North Zone Season Date Considerations

Specific to season date considerations for the 60-day North Zone Season, 69% of survey respondents and 80% of workshop participants expressed a desire for later seasons. Although both split season and continuous season options were considered, ultimately a continuous season that opens a week later than the 2011-2016 seasons was the final recommendation. This choice was made because North Zone workshop participants indicated that even though they wanted later season dates, they also wanted to maintain as many November days as possible. Additionally, workshop participants expressed no interest in a season structure that utilized a split in mid-December that would retain as many November days as possible while also providing an additional week of later hunting. Changing the opening date from the last Saturday

in October to the first Saturday in November, eliminated days in October but only a few days in November during most years. According to this formula opening day has the potential to open from Nov. 2 – Nov. 7 and will benefit hunters with earlier season preferences during some years and those with later season preferences in other years.

Impacts of this season date formula during the first two years included the following: 1) It provided 7 days of additional late season hunting opportunity that benefitted those who hunt fields, rivers, reservoirs, private hunters who have the capability to keep water open, and those who simply wanted later seasons, 2) it resulted in missing significant migration events both years, and 3) it resulted in the loss of some shallow water hunting opportunity, especially in the northern counties of Missouri.

Middle Zone Season Date Considerations

Similar to the North Zone, Middle Zone hunters expressed a desire for later seasons than they have had prior to 2016. Fifty-five percent of survey respondents and 75% of workshop participants wanted later seasons in the Middle Zone. This translated into hunters wanting the opportunity to hunt later into January. The two methods to provide additional late season opportunity included delaying the opener or offering a split at any time during the season. Hunters indicated that they were much more in favor of sacrificing days early in the season rather than later in the season. An undesirable outcome of moving the season opener a week later is that it would fall on the deer season opener and force hunters, including 70% of Middle Zone hunters who also hunt deer, to choose between participating in either the duck season opener or deer season opener. In addition, many hunters indicated that they would like to try a split season. With these considerations, the recommended season date formula provided additional late season hunting opportunity, avoids conflicts with deer and duck season opening on the same weekend, and provides hunters with experience with a split season.

The Middle Zone formula changed from the 1st Saturday in November to a split season that opens the first segment for 7 days beginning on the Saturday nearest November 6, closes for a 5-day split, and reopens the second segment for the remaining 53 days. This change resulted in a 5-day decrease in days during early season (the 4th Oct and 1st week of November) and a 5-day increase during late season (the 4th week of December and 1st week of January). In 2019 and 2020, this formula calls for the season to close on January 12 and 10, respectively. Previously, January 5th was the latest closing date in the Middle Zone.

Impacts of this season date formula during the first two years include the following: 1) It provided 5 days of additional hunting opportunity in January, 2) it provided a “second opener” with higher harvest on the first day of the second segment, and 3) the season was closed either during or shortly after the most significant migration events each year. A season date formula that opens on the Saturday nearest November 6 results in seasons that are significantly later during some years than a formula that opens on the Saturday nearest November 1. In 2019, the season closes 12 days later than it would have using the previous formula of opening on the first Saturday in November. We do not have data yet to evaluate the impacts of this later closing date.

South Zone Season Date Consideration

Forty percent of South Zone survey respondents and 61% of South Zone workshop participants

wanted later seasons. Additionally, 53% of survey respondents and 76% of workshop participants from the Bootheel, the region with the most duck hunting in the South Zone, preferred later seasons. This option extends the season as late as possible while preserving hunting opportunity over the Thanksgiving weekend, a popular time to hunt for many duck hunters. The season dates more closely match the season dates in surrounding states. The change likely provides the most benefit to hunters in the Bootheel and Southwest Missouri where more mallards winter and less benefit to the 37% of South Zone hunters that actually expressed interest in season dates that better match those offered in the North and Middle zones. Unfortunately, there was no good way to reach a compromise that would benefit this group of hunters along with those who wanted dates to remain the same or later than pre-2016 season dates.

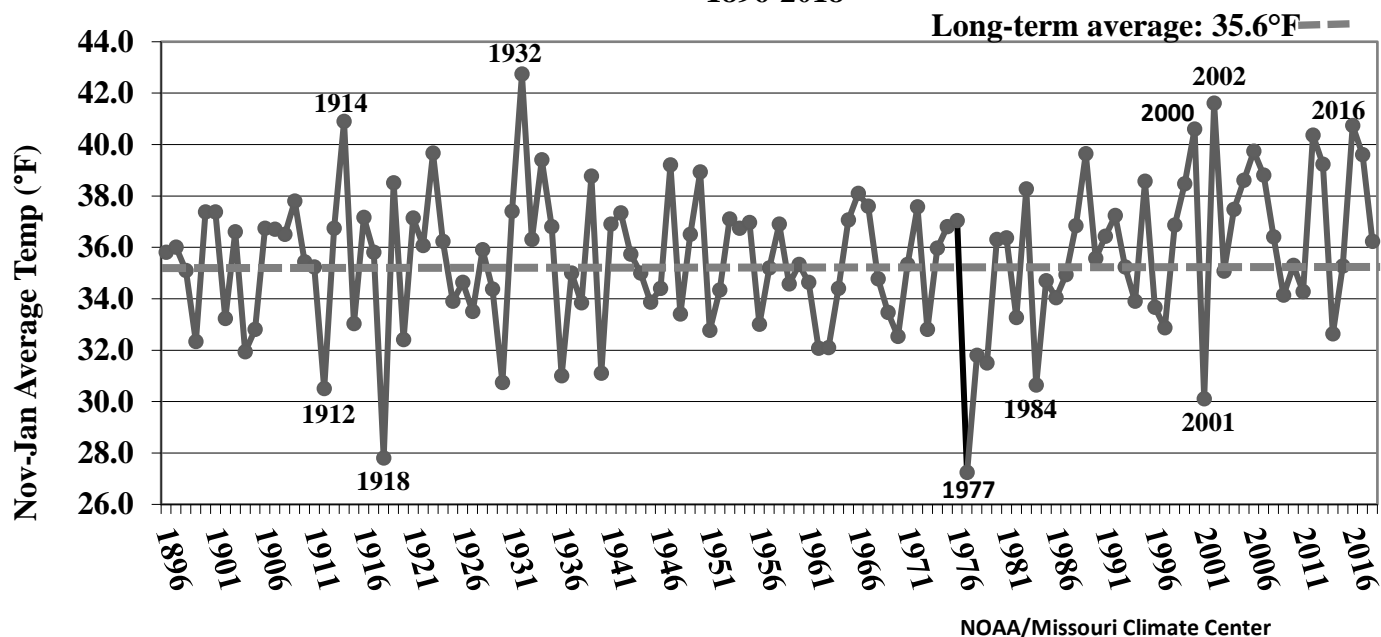
Table 3. Season date formulas for the North, Middle, and South Zone, 2017-2020.

	60-day Season	45-day Season	30-day Season
North Zone	First Sat. in November	Second Sat. in November	Sat. nearest November 14
Middle Zone	Sat. nearest Nov 6 for 7 days, close 5, open 53 days	Sat. nearest Nov. 15	Sat. nearest Nov. 19
South Zone	Thanksgiving Day for 4 days, close (if needed), open as late as federal frameworks allow.	Sat. nearest Dec. 10, close Dec. 20-25, open as late as federal frameworks allow.	Sat. nearest Dec. 15, close Dec. 19-25, open until Sunday nearest Jan. 20

Weather

Temperatures vary annually in Missouri, and dramatic differences may occur from one year to the next. The chart below shows that fall temperatures (November-January) were well above the long-term average during the 1930s but were generally below the long-term average from the mid-1970s to the early to mid-1990s. Fall temperatures during the 2000s were generally above normal, but the decade ended with two years just below normal. This trend continued during the 2010s with above average fall temperatures in six years, near average or slightly below average for three years and below average occurring only once during the decade (Figure 3). Although climate models generally suggest the possibility of warmer temperatures over the next century in Missouri, it is uncertain how annual fluctuations, long-term cyclical patterns, and climate change will influence the weather patterns over the next five years.

**Figure 3: Missouri Average November-January Temperature
1896-2018**



Harvest

Figure 4 depicts how much each of the 14 regions contributed, on average, to the overall statewide harvest based on FWS harvest estimates and mallard band recoveries from 2011-2016. Although patterns based on FWS estimates and mallard band recoveries differ slightly, together they provide some indications about the statewide distribution of harvest. Hunters in West Central Missouri accounted for 19% of the statewide harvest. This region covers a large geographic area and includes more habitat than most regions with the combination of public and private hunting opportunity associated with Truman Reservoir and several public areas including Schell-Osage CA, Four Rivers CA, and Montrose CA. St. Charles and Stoddard regions represent a much smaller geographic area but each region still accounted for 9% of the average statewide harvest estimate from 2011-2016.

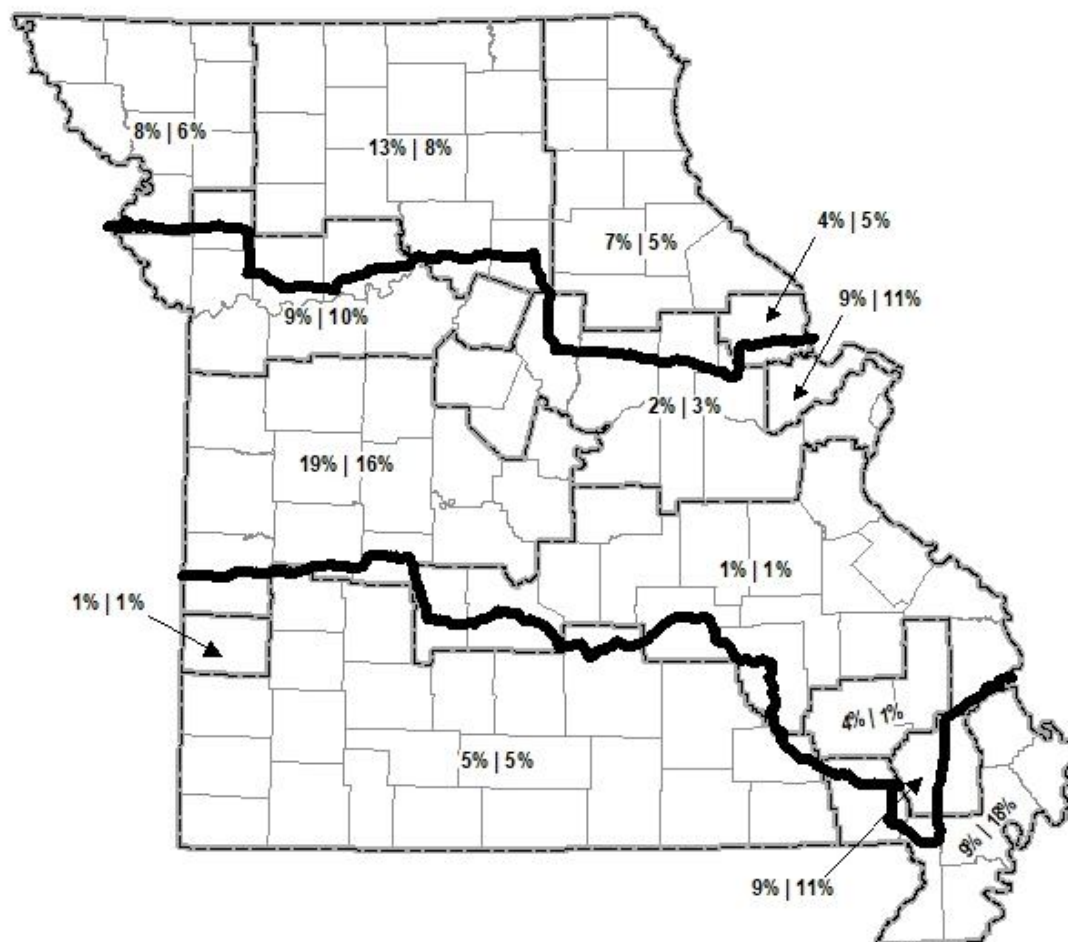


Figure 4. Percent each of the 14 regions contributed to statewide harvest from 2011-2016 based on U.S. Fish and Wildlife harvest estimates (first number) and mallard band recoveries (second number).

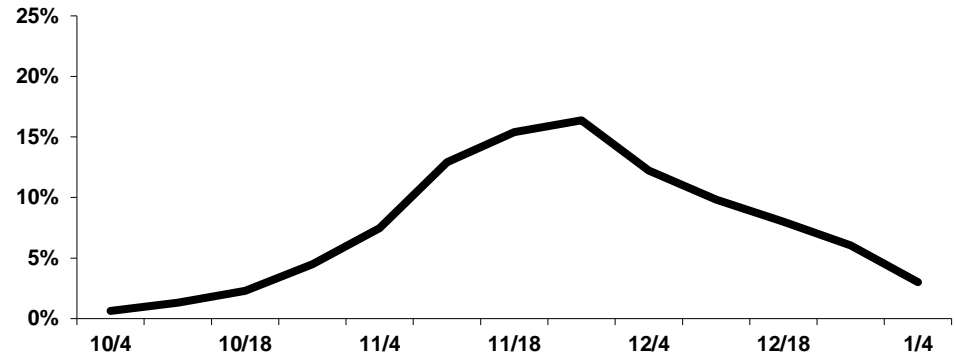
Migration and Harvest Trends in the North, Middle, and South Zones



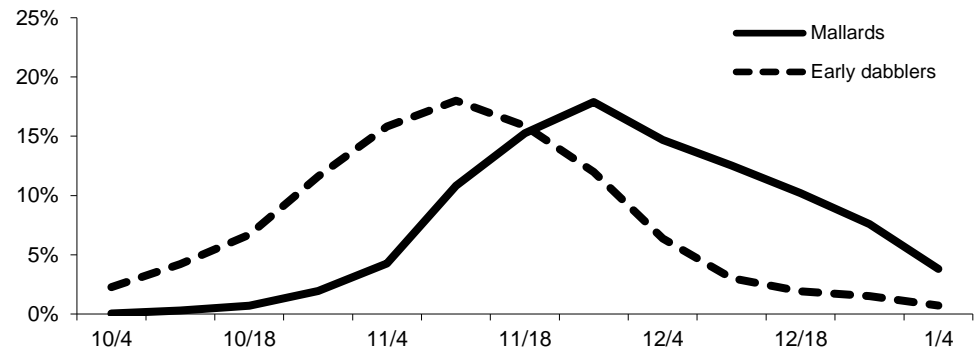
North Zone

North Zone Migration Timing: Migration time varies annually. The top chart to the right presents the average migration pattern over the past 10 years in the North Zone based on waterfowl counts at Loess Bluffs NWR, Nodaway Valley CA, Fountain Grove CA, Swan Lake NWR, Ted Shanks CA, Clarence Cannon NWR, and BK. Leach CA. Migration events or flight days in mid- to late-October through November result in increasing numbers of ducks until the end of November when they typically peak. Numbers rapidly decline throughout December as habitats begin to freeze up. Flight days in mid- to late-October of early season migrants contribute to their peak in early to mid-November (lower chart). Mallard numbers peak in late November with the first major migration often occurring during the second week of November.

Percent of duck use by week on state and federal refuges in the North Zone:
10-year average.

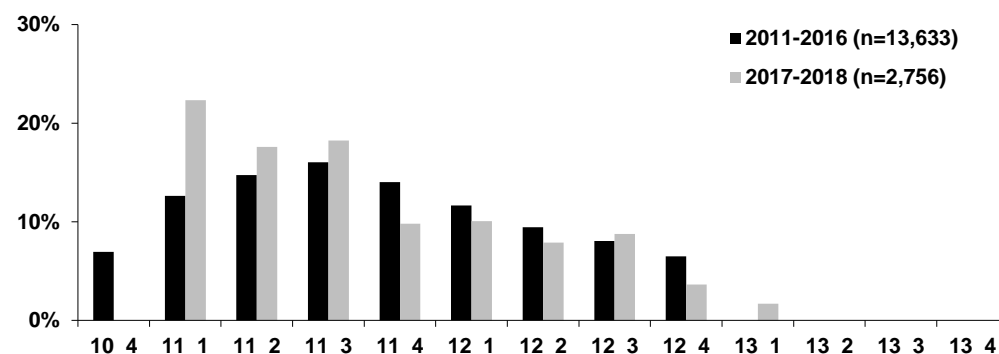


Percent mallard and early migrant use by week on state and federal refuges in the North Zone: 10-year average.

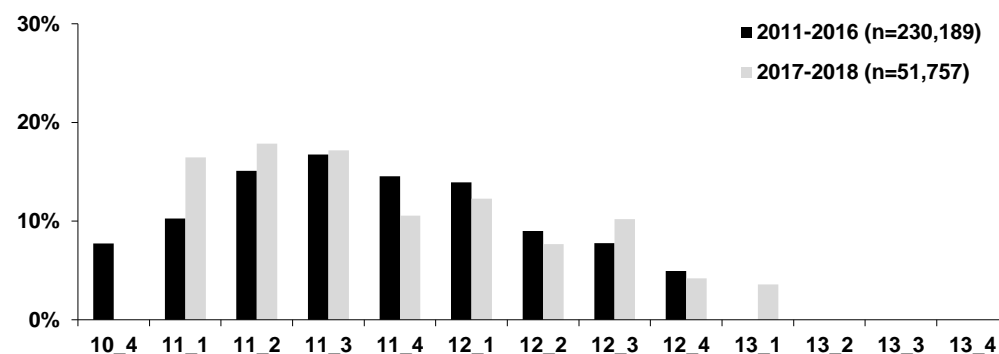


North Zone Harvest: FWS harvest data, excluding opening weekends, suggests during 2011-2016 harvest gradually built toward a peak the third week in November and steadily declined throughout the remainder of the season (top chart). During 2011-2016, 20% of the harvest occurred during the last week of October and the first week of November compared to 15% of the harvest during the last two weeks of December. Even with later seasons during 2017-2018, the early season contributed a higher portion of the harvest than late season. The 2011-2016 harvest pattern at MDC intensively managed wetland areas (Bob Brown CA, Nodaway Valley CA, Fountain Grove CA, Ted Shanks CA, and B.K. Leach CA) is virtually identical to that suggested by the FWS harvest data with peak harvest occurring the third week of November and declining thereafter (middle chart). In 2017-2018, harvest on public lands peaked in the second and third weeks of November then fluctuated thereafter reflecting the freeze-thaw patterns that occurred during these two seasons. Mallard band recoveries suggest a similar pattern (bottom left chart). Approximately 70% of duck species other than mallards are harvested during the last week of October through the third week of November (bottom right chart). The bulk of mallard harvest on public lands occurs during the second and third weeks in November and the first week of December.

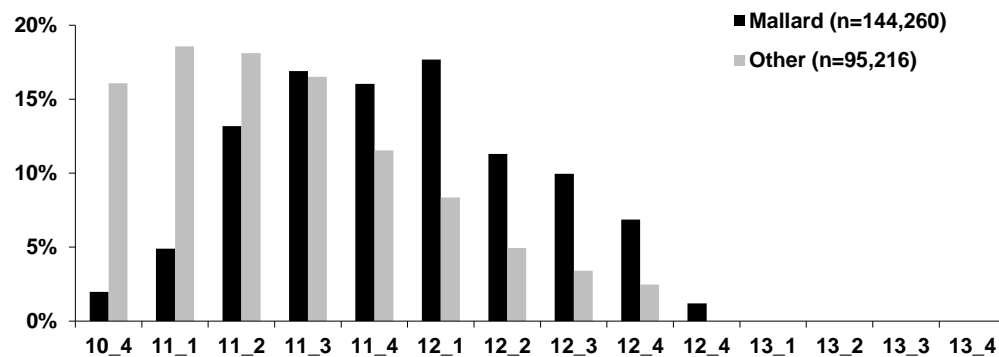
Percent average daily harvest per week on public and private ground in the North Zone (FWS data).



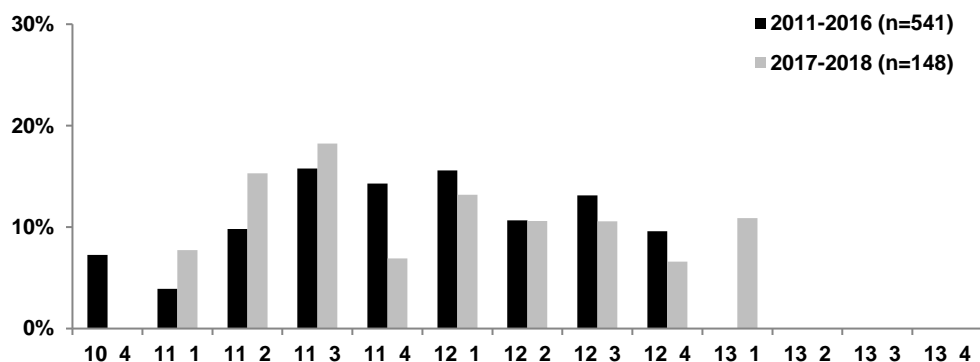
Percent average daily harvest per week of all ducks at North Zone at MDC intensively managed wetland areas.



Percent average daily harvest per week of mallards and other ducks at MDC intensively managed wetlands: 2011-2016.



Percent average daily mallard band recoveries per week in the North Zone.

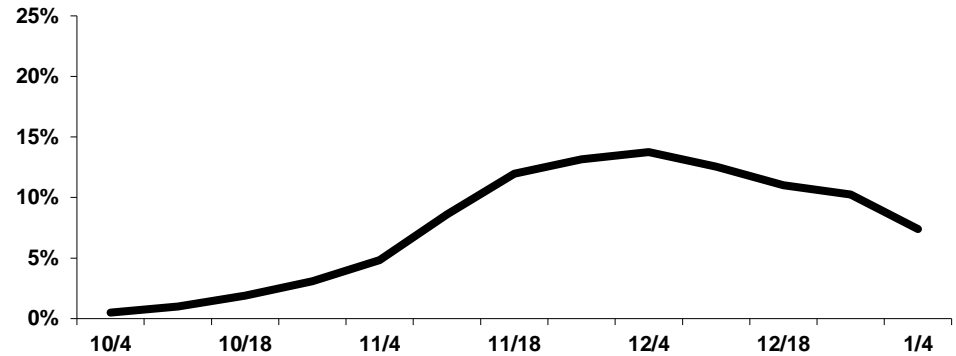


Middle Zone

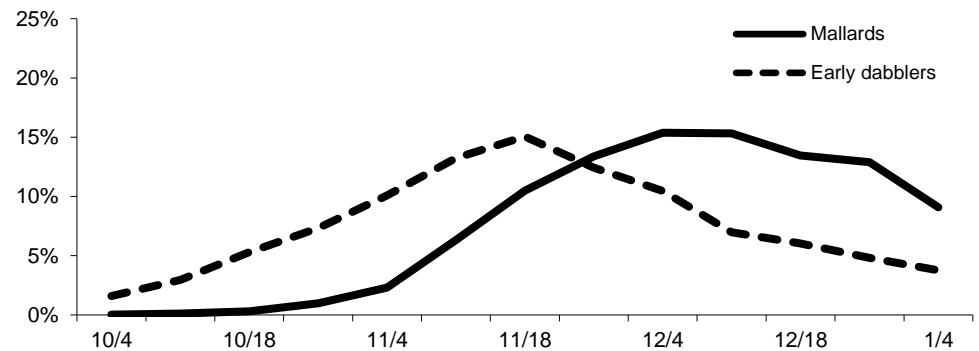
Middle Zone migration timing: Migration time varies annually. The top chart to the right presents the average migration pattern over the past 10 years in the Middle Zone based on waterfowl counts at Columbia Bottom CA, Grand Pass CA, Eagle Bluffs CA, Four Rivers CA, Mingo NWR, Duck Creek CA, and Otter Slough CA. Migration events or flight days in mid- to late-October through November result in increasing numbers of ducks until the first week in December when they typically peak. Numbers gradually decline throughout December as habitats begin to freeze up. Flight days of early season migrants typically occur in mid- to late-October and early November and their numbers typically peak by mid-November (lower chart). Mallard numbers typically peak during the first week of December with the first major migration often occurring during the second week of November. Due to milder conditions than in the North Zone, mallards tend to remain throughout much of December.



Percent of duck use by week on state and federal refuges in the Middle Zone:
10-year average.



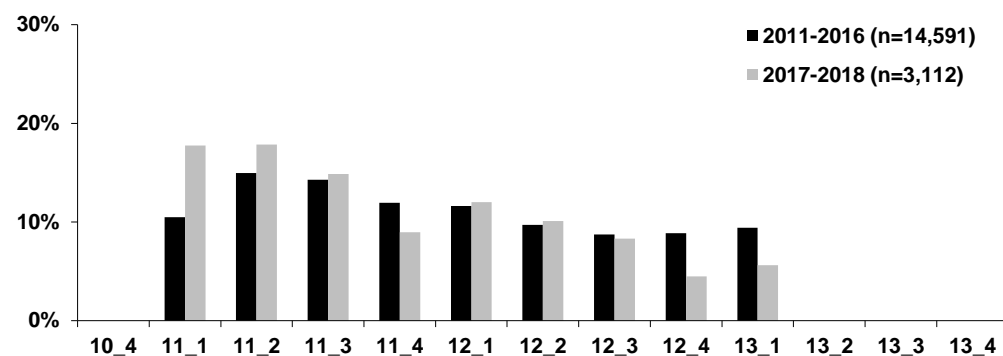
Percent mallard and early migrant use by week on state and federal refuges in the Middle Zone: 10-year average.



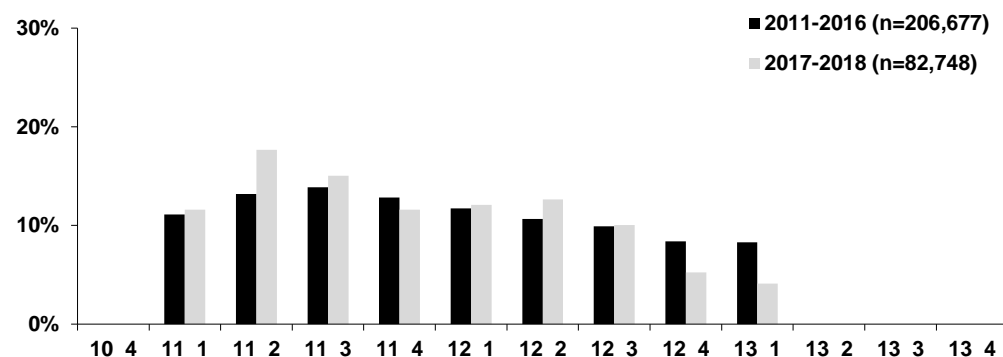
Middle Zone Harvest:

FWS harvest data, excluding opening weekends and the first day of the second segment, indicate that during 2011-2016 peak average daily harvest occurred during the second week of November, remained steady during early to mid-December, and then declined in late December and early January (top chart). During 2011-2016, 25% of the total average daily harvest occurred during the first two weeks of November compared to 18% during the last two weeks of season. During 2011-2016, the harvest pattern on MDC intensively managed wetlands in the Middle Zone (Grand Pass CA, Eagle Bluffs CA, Columbia Bottom CA, Four Rivers CA, Duck Creek CA, and Otter Slough CA) remained relatively constant throughout the season with slightly higher harvest earlier in the season than later in the season (middle chart). In 2017-2018, 29% of the average daily harvest occurred during the first two weeks of November compared to 9% during the last week in December and first week in January. The highest mallard harvest on MDC wetlands occurs during the second and third weeks in November and the first week of December. The daily average number of mallard band recoveries is slightly higher in late December and early January (bottom left chart). Approximately 48% of duck species other than mallards are harvested during the first three weeks of November (bottom right chart).

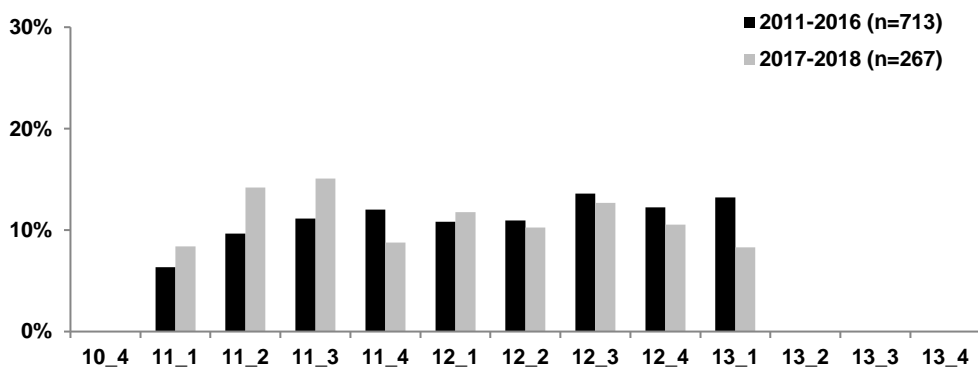
Percent average daily harvest per week on public and private ground in the Middle Zone (FWS data).



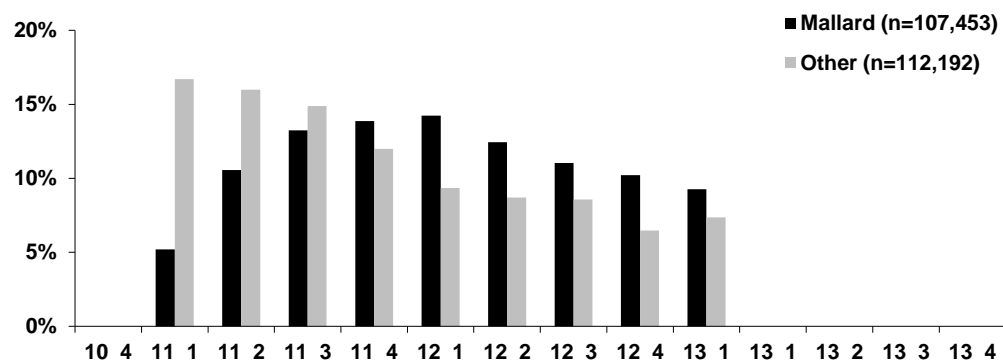
Percent average daily harvest per week of all ducks on MDC intensively managed wetlands in the Middle Zone.



Percent average daily mallard band recoveries per week in the Middle Zone.



Percent average daily harvest per week (excluding opening weekend) of mallards and other ducks on MDC intensively managed wetlands in Middle Zone: 2011-2016.

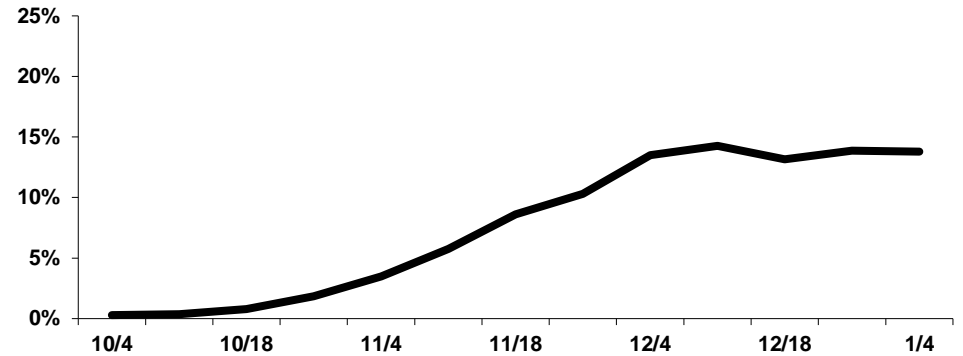


South Zone

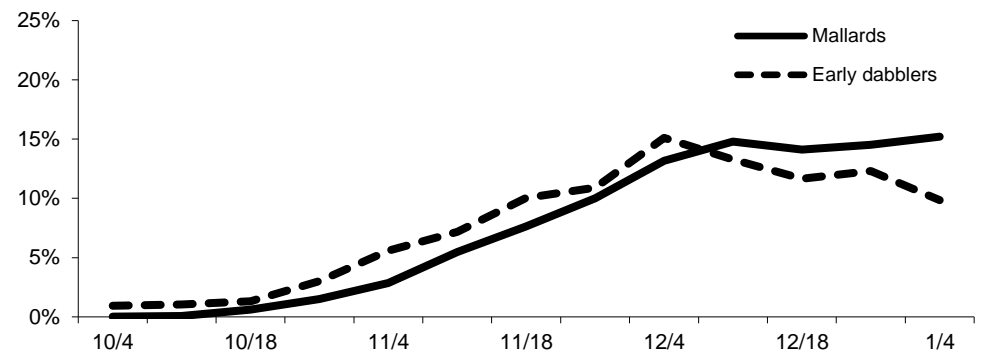
South Zone Migration Timing: Ten Mile Pond CA is the only public wetland area represented in the South Zone, so migration timing is based on data from this area. We do not have data from the western portion of the South Zone where shallow water wetlands, irrigation lakes, and reservoirs are found. The 10-year data illustrates a relatively steady build-up of duck use through early December before use plateaus and remains relatively constant for the remainder of the period of record. Data is truncated due to lack of long-term information extending through January (top chart). When freeze ups occur ducks often move only a short distance and may return within a few days. Early dabbler use builds through November, peaks in early December and then gradually declines. Mallard use continues to build through December and likely peaks in early to mid-January (middle chart). Again, although not reflected in the Ten Mile Pond data, flights of divers likely occur on large reservoirs present in this Zone in association with flight days.



Percent of duck use by week in the South Zone (Ten Mile Pond CA): 10-year average.

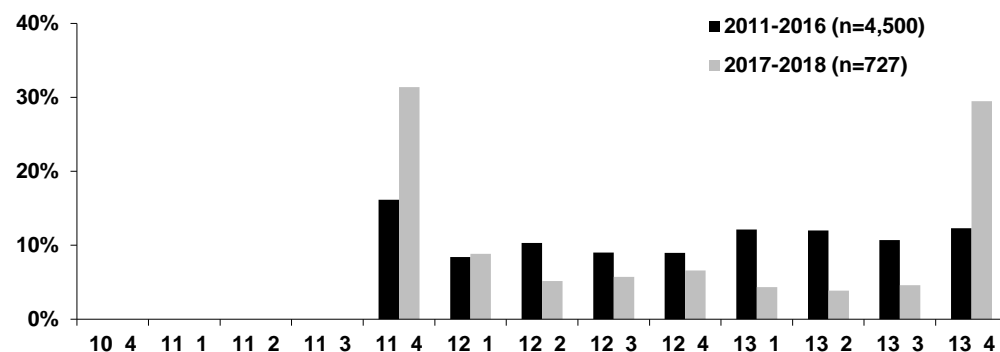


Percent mallard and early migrant use by week in the South Zone (Ten Mile Pond CA): 10-year average.

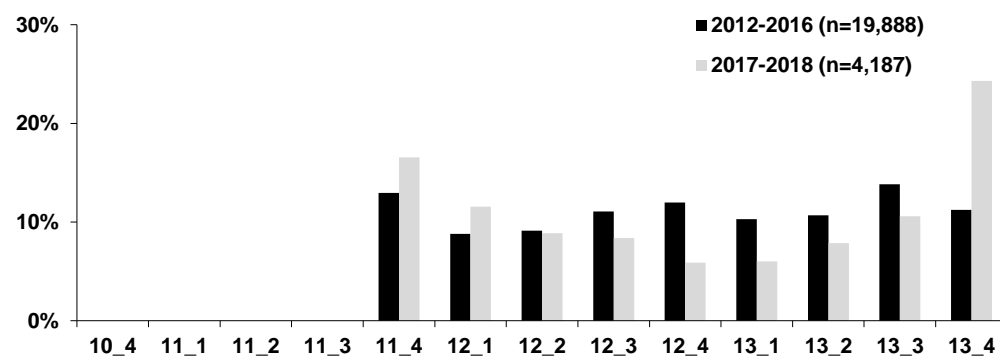


South Zone Harvest: Based on FWS harvest estimates, during 2011-2016, excluding opening weekends and the first day of the second segment, average daily harvest peaked the fourth week of November, declined from 16% of season total to 8% the first week in December and remained somewhat constant with average daily harvest per week ranging from 9 to 13% during each of the remaining weeks of the season (top chart). In 2017-2018, harvest peaked the first week of the season (fourth week in November) and then steadily declined until a second peak that occurred the last week of the season (fourth week of January). Harvest at Ten Mile Pond CA shows a similar pattern in both time periods with relatively steady harvest throughout the 2011-2016 season whereas, in 2017-2018, peaks in harvest occurred in late November/early December and in late January. Compared to other regions, there is little difference in the timing of mallard harvest compared to other species (bottom right chart). Mallard band recoveries in both time periods (2011-2016 and 2017-2018) suggests a peak of harvest occurs in late-January (bottom left chart).

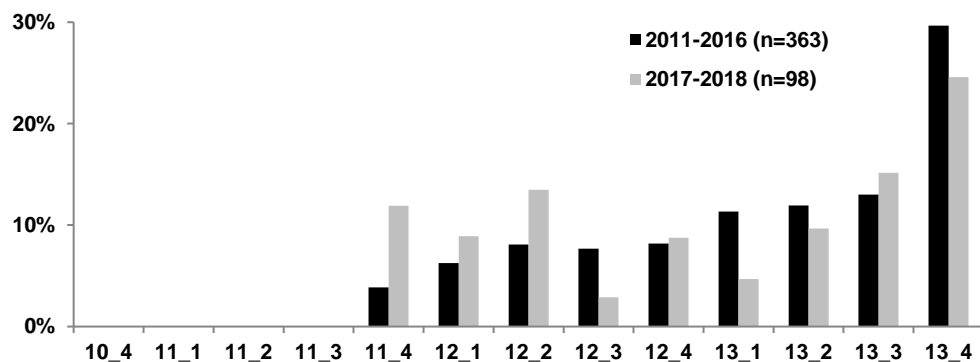
Percent average daily harvest per week on public and private ground in the South Zone (FWS data).



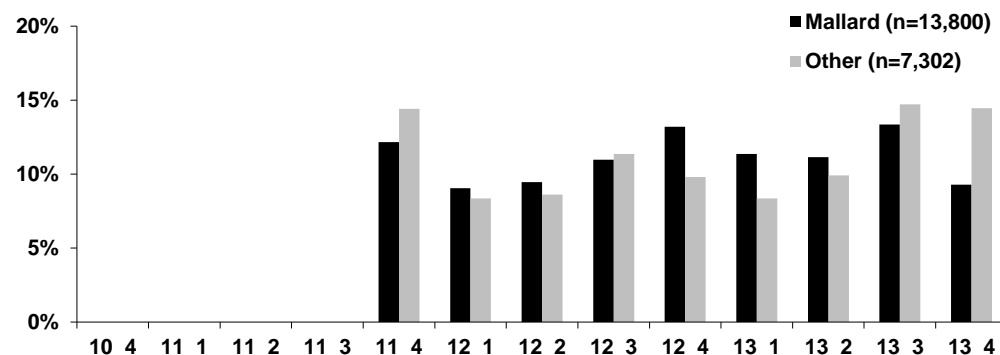
Percent average daily harvest per week of all ducks on MDC intensively managed wetlands in the South Zone (Ten Mile Pond CA).



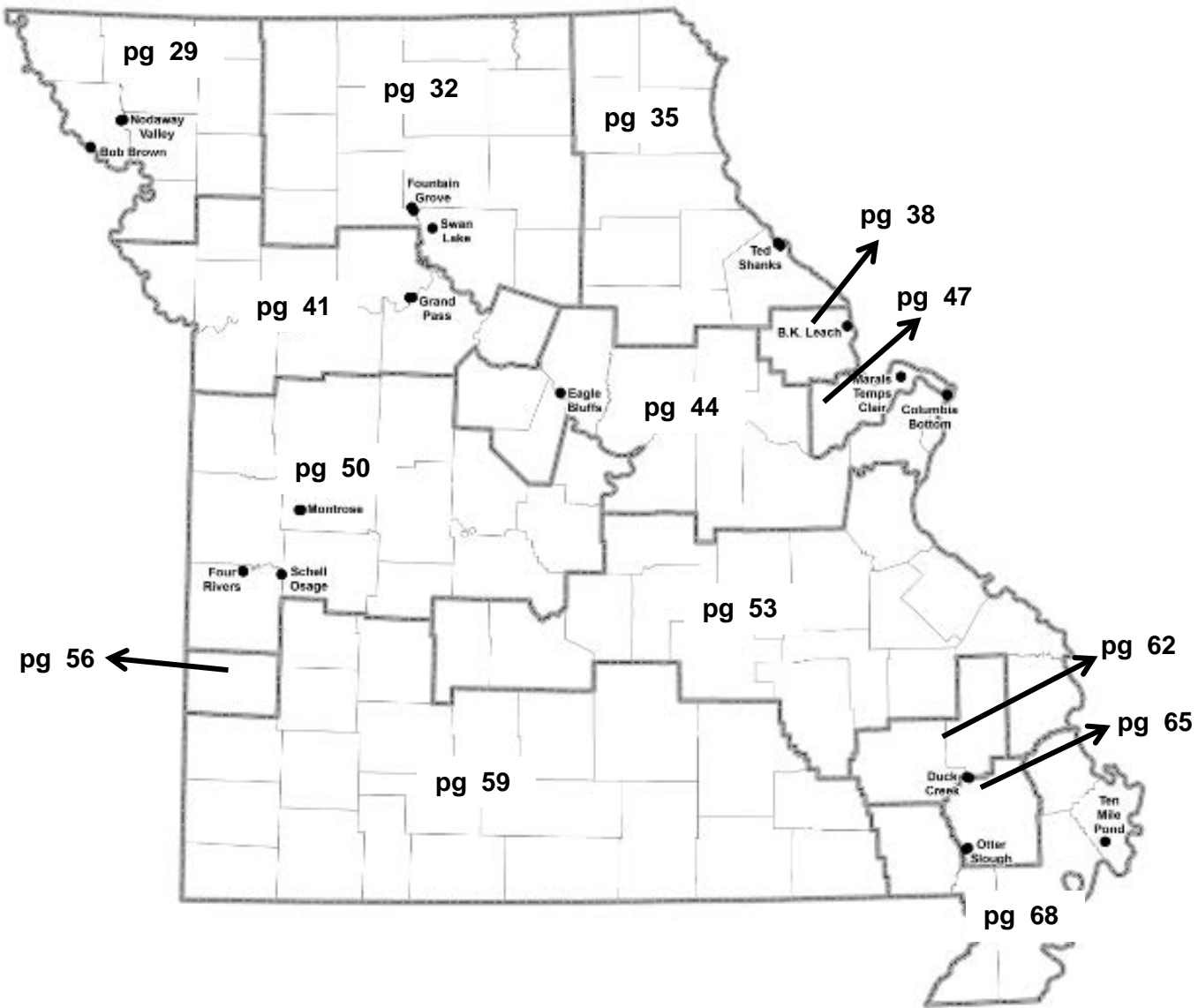
Percent average daily mallard band recoveries per week in the South Zone.



Percent average daily harvest per week of mallards and other ducks on MDC intensively managed wetlands in the South Zone (Ten Mile Pond CA): 2011-2016.



Weather, Migration, and Harvest Trends in 14 Regions of Missouri

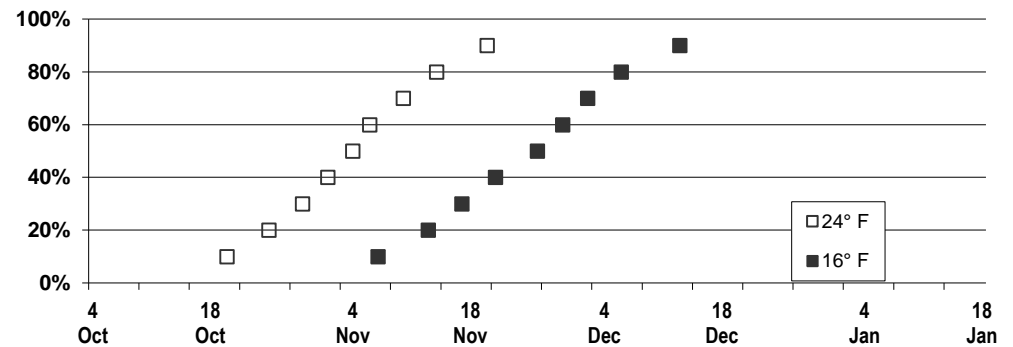


Northwest

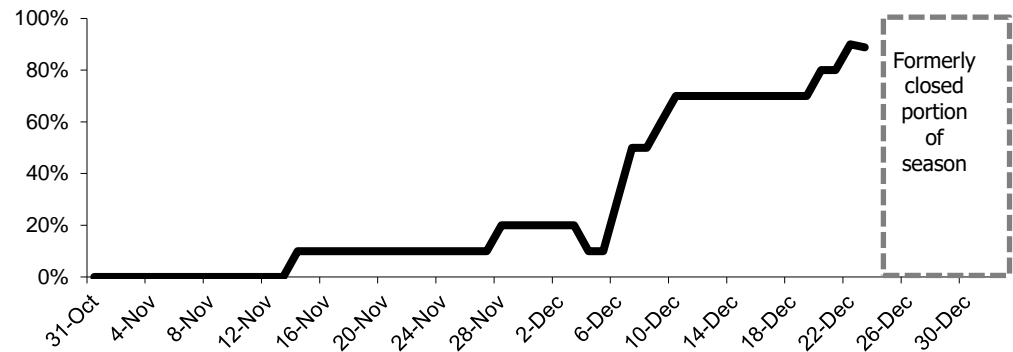
Northwest Weather: Precipitation in this region gradually declines from late summer through fall. Average low temperatures fall below freezing by mid-November. There is a 50% probability of achieving a low temperature of 24° F and having the first skim ice by November 4 (top chart). By December 13, there is a 90% chance temperatures will dip down to 16° F and form more significant ice. During 2007-2016, Bob Brown lost an average of 12.5 days each year to icy conditions (middle chart) whereas during the 2017 and 2018 seasons, they lost an average of 16.5 days to ice (bottom chart).



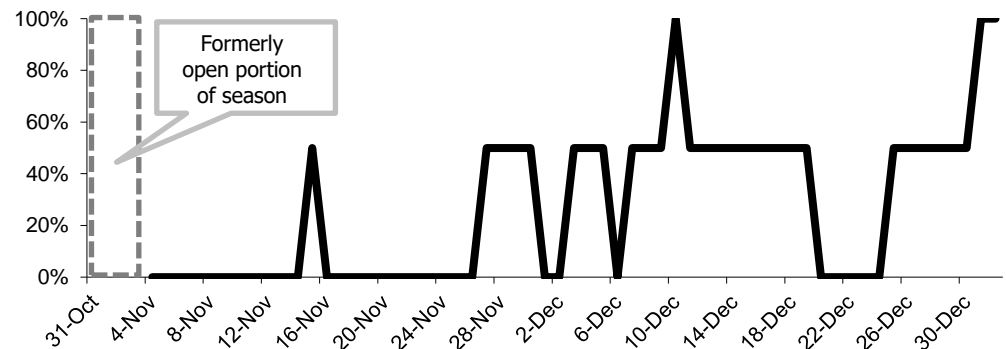
Probability (%) that a temperature of 24° F and 16° F will be reached by date at St Joseph, MO.



Percent of years Bob Brown CA had ice > 2 inches throughout the season during the period 2007-2016. The dashed rectangle highlights portion of season closed prior to 2017.

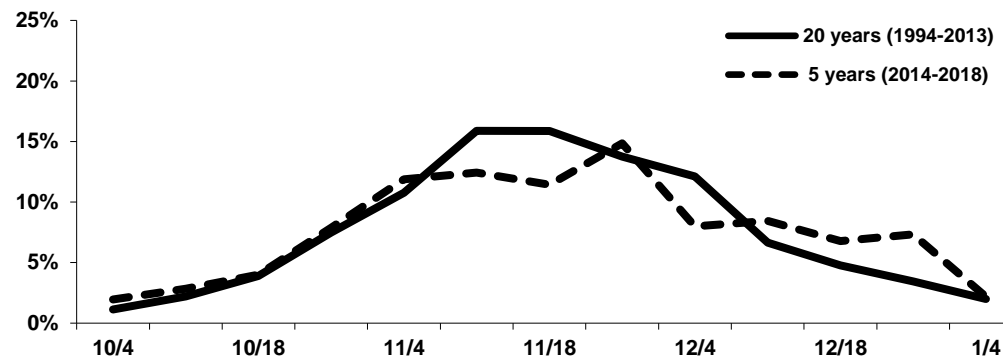


Percent of years Bob Brown CA had ice > 2 inches during 2017 and 2018 seasons. The dashed rectangle highlights a portion of season open prior to 2017.

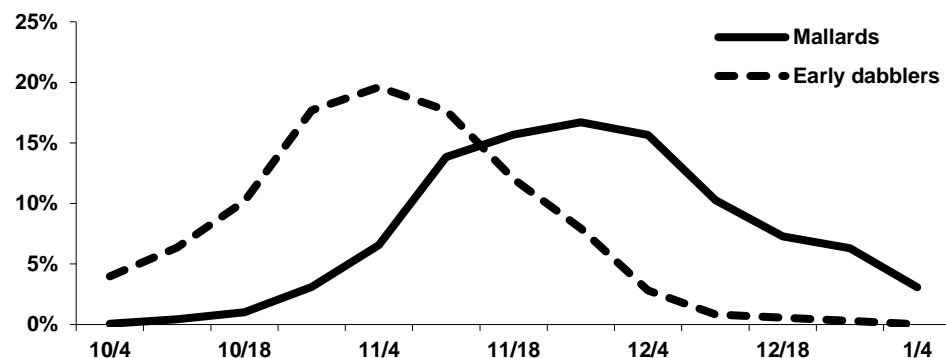


Northwest Migration Timing: The long-term pattern of duck use at Loess Bluffs NWR exhibits a gradual buildup through mid-November and a steady decline during late November and December (top chart). The 5-year average suggests a slower buildup with fewer birds present in mid-November as use peaks in late November, sharply drops off through early December and then somewhat steadily declines thereafter with more birds present in late December than suggested by the 20-year average. Early migrant use typically peaks during late October to mid-November and then declines throughout the remainder of November with few of these birds present after early December (bottom chart). Mallard numbers are somewhat steady from early November through late November before beginning a relatively sharp decline through December as ice conditions develop.

**Percent of duck use by week (Loess Bluffs NWR):
20- year average and 5-year average.**

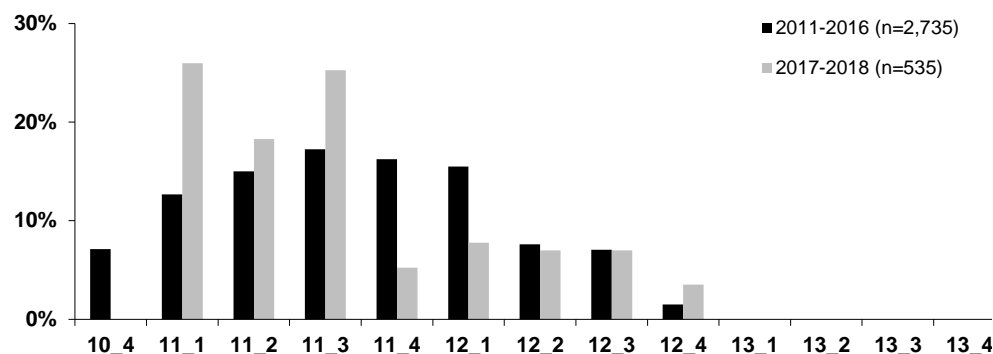


**Percent of mallard and early migrant use by week (Loess Bluffs NWR):
25-year average.**

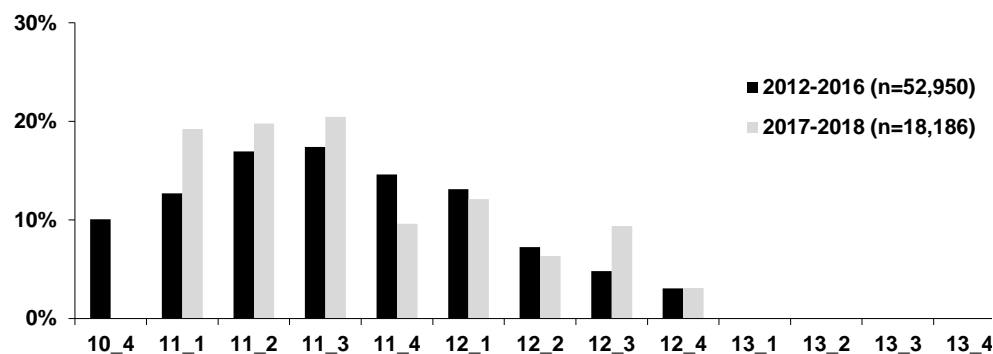


Northwest Harvest: During 2011-2016, excluding opening weekends, FWS harvest data suggests harvest in the Northwest Region steadily increased from the last week in October through mid-November, remained somewhat steady through the first week in December and then declined sharply thereafter with the onset of ice. In 2011-2016, 20% of the total average daily harvest occurred during the last week of October and first week in November compared to 9% during the last two weeks in December. In 2017-2018, MDC moved the season a week later. During these two years, excluding opening weekends, 75% of daily average harvest occurred in November, compared to 25% in December and early January (top chart). A similar harvest pattern occurred at Bob Brown CA and Nodaway Valley CA in 2012-2016 and 2017-2-18 with a notable decline in harvest after the first week in December (middle chart). Twenty-two percent of duck species other than mallards are harvested during the first week of November (bottom right chart). Mallard harvest peaks, on average, during the first week of December. The most mallard band recoveries were also reported during the first week of December (bottom left chart).

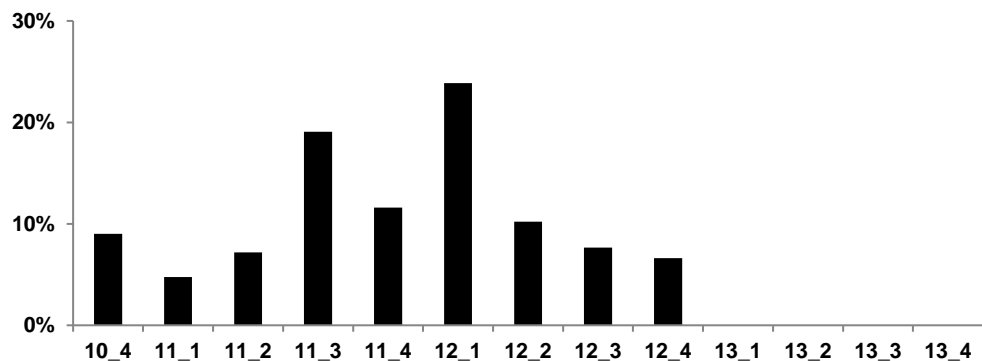
Percent average daily duck harvest per week on public and private ground in the Northwest Region (FWS data).



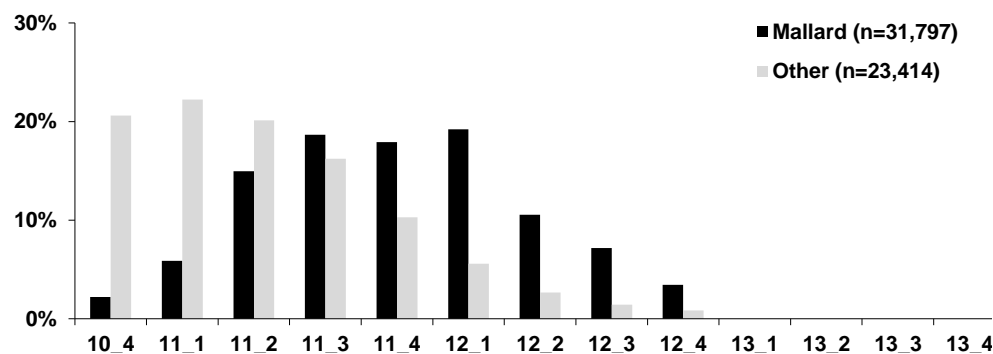
Percent average daily duck harvest per week at Bob Brown CA and Nodaway Valley CA.



Percent average daily mallard band recoveries per week in the Northwest Region: 2011-2016 (n=93).



Percent average daily harvest per week of mallards and other ducks at Bob Brown CA and Nodaway Valley CA: 2012-2016.

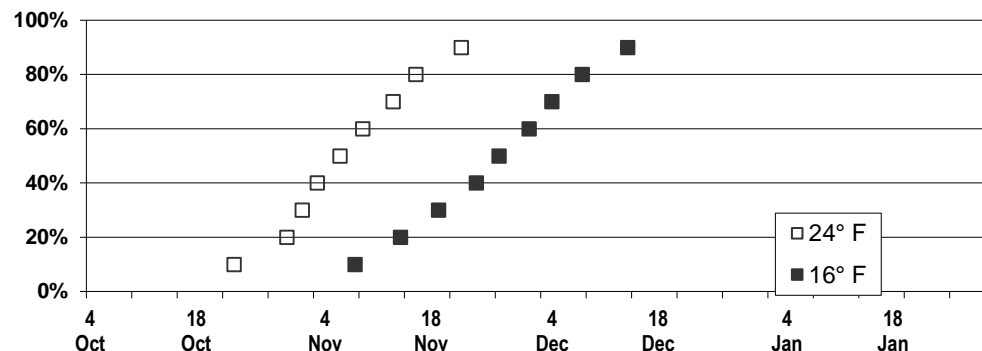


North Central

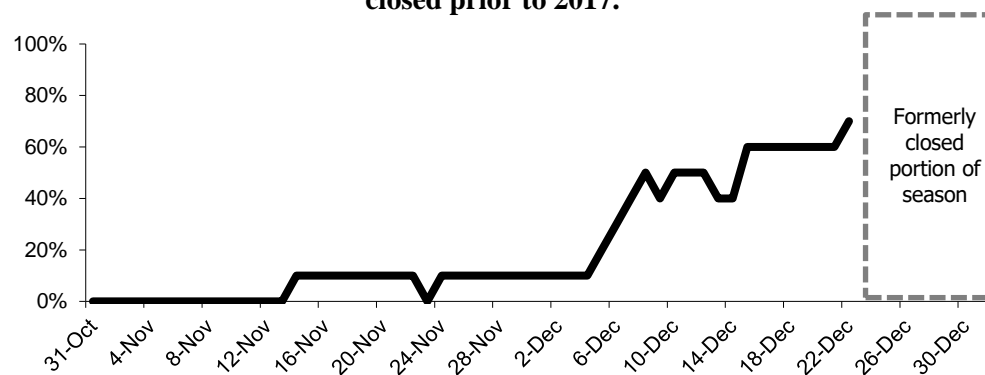
North Central Weather: Precipitation patterns in this region, although somewhat wetter, are similar to Northwest Missouri. Precipitation amounts gradually decline after September. Freezing conditions initially occur during mid-November and there is a 50% probability for a low temperature of 24° F that will likely create skim ice by November 6 (top chart). By December 16 there is a 90% chance of a low temperature of 16° F that will likely create more substantial ice. During the 2007-2016 period, Fountain Grove CA has had ice two or more inches thick in 60% of the years by December 16 (middle chart). During this period, they lost an average of 12.6 days each year to icy conditions whereas during the 2017 and 2018 seasons, they lost an average of 8.5 days (bottom chart).



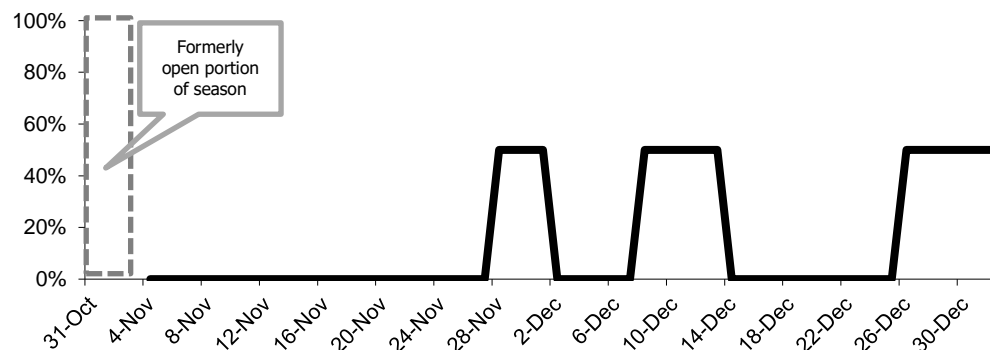
Probability (%) that a temperature of 24° F and 16° F will be reached by date at Brookfield, MO.



Percent of years Fountain Grove CA had ice > 2 inches throughout the season during the period 2007-2016. The dashed rectangle highlights portion of season closed prior to 2017.

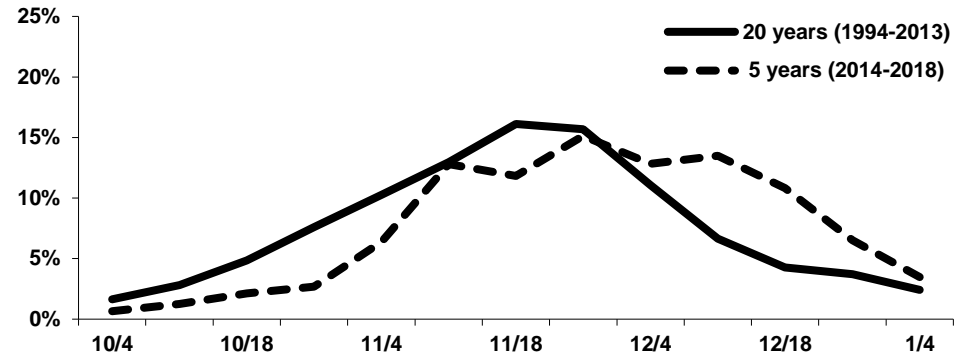


Percent of years Fountain Grove CA had ice > 2 inches during 2017 and 2018 seasons. The dashed rectangle highlights a portion of season open prior to 2017.

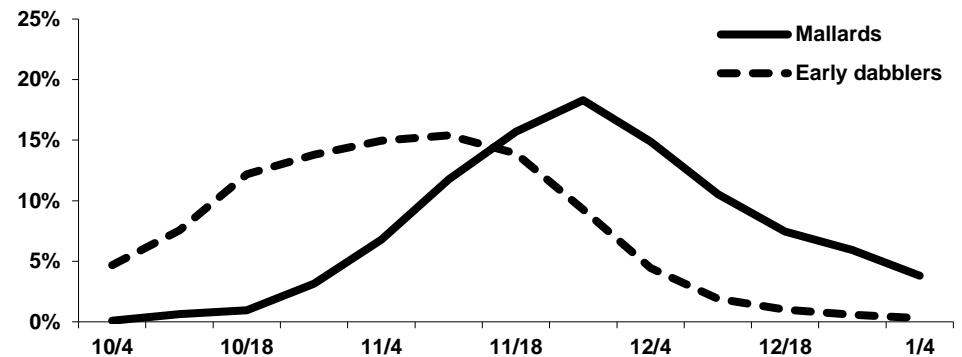


North Central Migration Timing: Duck use in this region typically peaks by the third or fourth week in November (top chart). During the past five years, duck numbers have gradually increased through late October and peaked the fourth week of November. The decline in duck numbers after the peak appears to be more gradual in the recent five years compared to the previous 20 years. Mid-November weather fronts that often bring early mallard flights also result in declining numbers of early season migrants (bottom chart).

**Percent of duck use by week (Fountain Grove CA and Swan Lake NWR):
20- year average and 5-year average.**

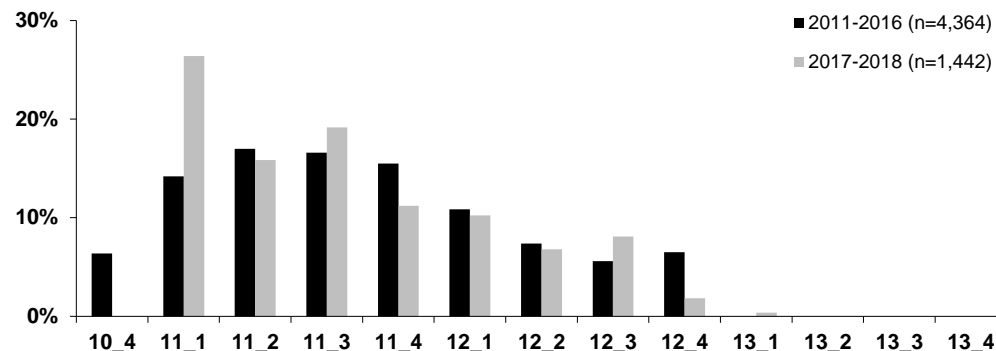


Percent of mallard and early migrant use by week (Fountain Grove and Swan Lake NWR): 25-year average.

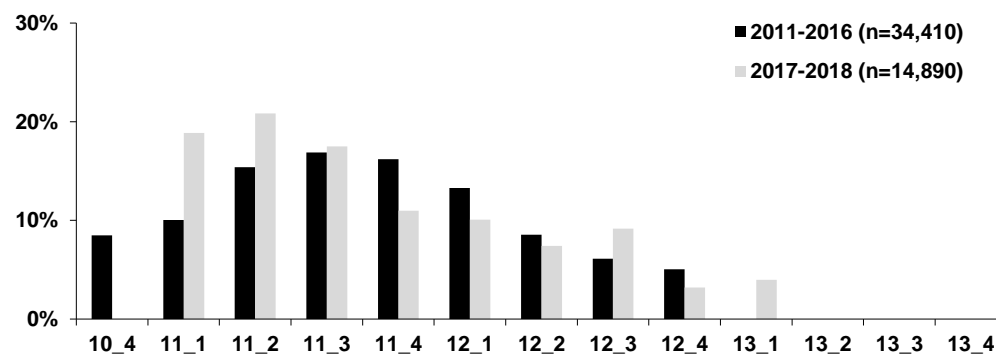


North Central Harvest: The FWS harvest estimate, excluding opening weekend, suggests that a substantial portion of harvest occurs through the first week of November in both time periods with 20% (6% the last week of October and 14% the first week of November) occurring in 2011-2016 and 26% occurring the first week of November in 2017-2018, excluding opening weekends. The remainder of the season exhibits a similar pattern in both periods with harvest relatively steady during the second through fourth weeks of November ranging from 11-19% of total each week before steadily declining through December. No harvest was reported in the first week of January in 2017-2018 (top chart). At Fountain Grove CA, harvest in 2011-2016 peaked at just over 16% of the total daily average daily harvest during each of the third and fourth weeks of November whereas 2017-2018 saw harvest peak during the first and second weeks of November at 19% and 21% of total, respectively (middle chart). Eighty-three percent of harvest of species other than mallards occurs during the fourth week of October and the four weeks of November (middle chart). The bulk of mallard harvest occurs in mid- to late November and early December with the third week of November, the fourth week of November and the first week of December each experiencing about 18% of total harvest (bottom right chart). Mallard band recovery estimates suggest harvest remains relatively steady from mid-November through mid- to late December (bottom left chart).

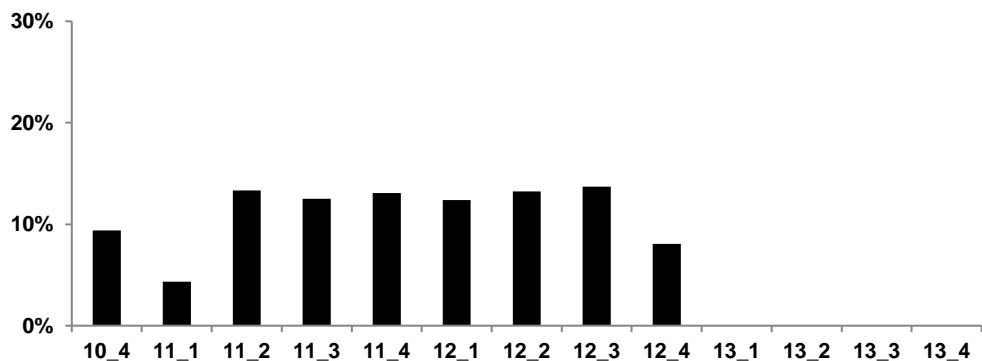
Percent average daily duck harvest per week on public and private ground in the North Central Region (FWS data).



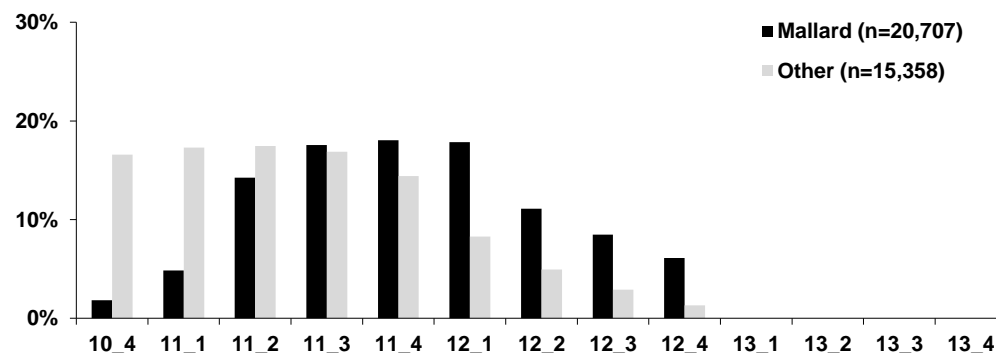
Percent average daily duck harvest per week at Fountain Grove CA.



Percent average daily mallard band recoveries per week in the North Central Region: 2011-2016 (n=133).



Percent average daily harvest per week of mallards and other ducks at Fountain Grove CA: 2011-2016.

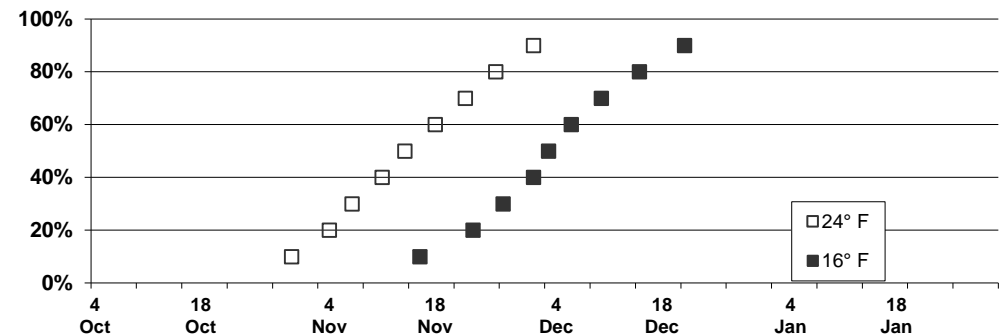


Northeast

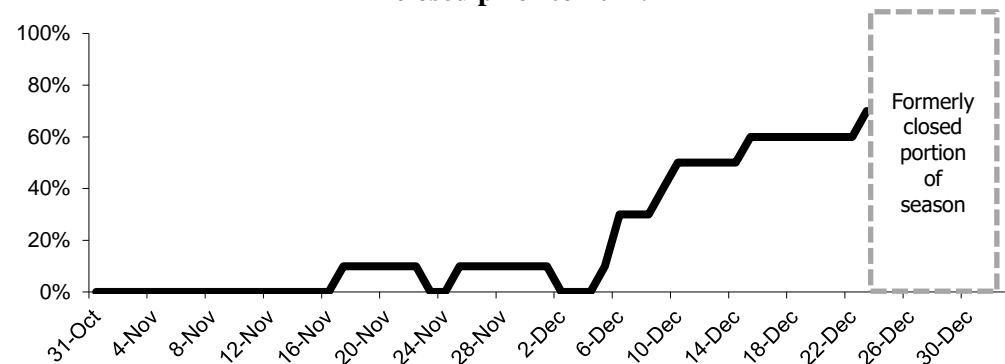
Northeast Weather: Similar to the other northern-tier regions, precipitation gradually declines throughout the fall and early winter, although not as dramatically as in the Northwest Region. Freezing conditions do not consistently occur until early December. There is a 50% probability of seeing a low temperature of 24° F by November 14, a week later than in the Northwest Region (top chart). By December 3 there is a 50% chance of seeing a minimum temperature of 16° F. During 2007-2016, Ted Shanks has had ice two or more inches thick by December 15 during 60% of the years (middle chart). During the 2007-2016 period, they lost an average of 8.6 days each year to icy conditions whereas during the 2017 and 2018 seasons, they lost an average of 8.5 days (bottom chart).



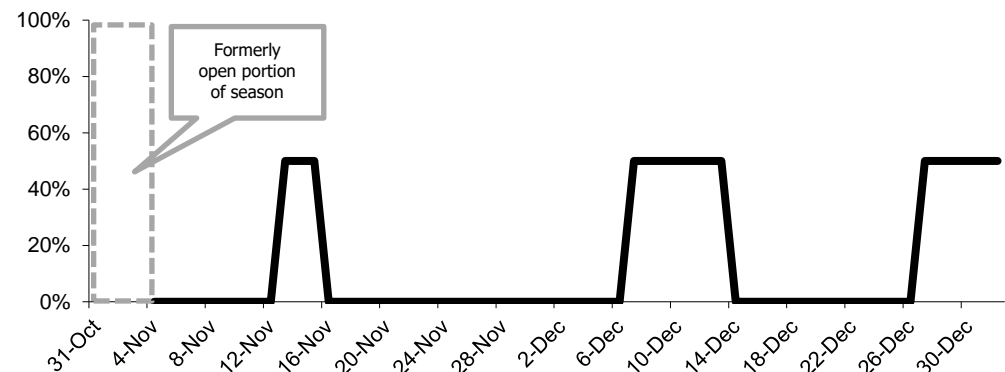
Probability (%) that a temperature of 24° F and 16° F will be reached by date at Hannibal, MO.



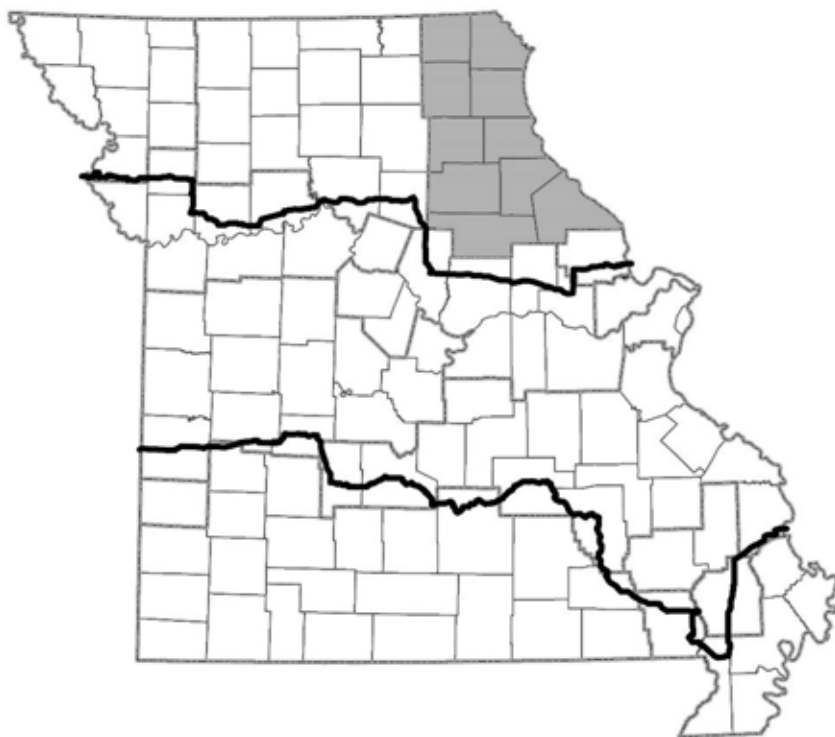
Percent of years Ted Shanks CA had ice > 2 inches throughout the season during the period 2007-2016. The dashed rectangle highlights portion of season closed prior to 2017.



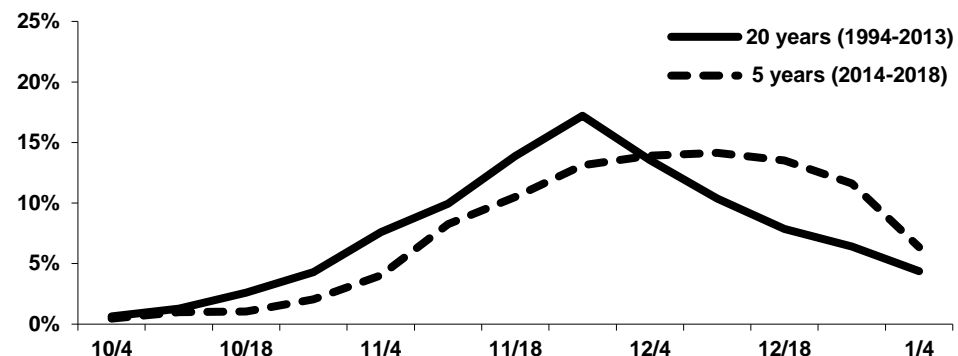
Percent of years Ted Shanks CA had ice > 2 inches during 2017 and 2018 seasons. The dashed rectangle highlights a portion of season open prior to 2017.



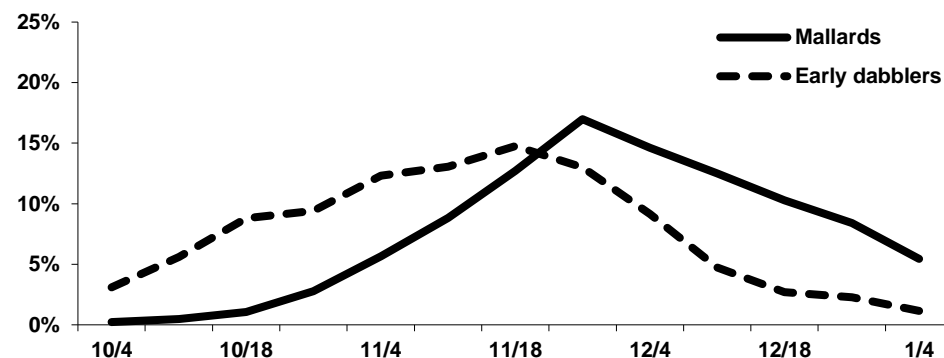
Northeast Migration Timing: Peak migration occurs about the fourth week of November in this region (1994-2013, top chart). Fewer ducks have been present in October during the last five years compared to the previous 20 years and more ducks have been present in December in recent years. Early season migrants exhibit a gradual buildup through mid-November and a gradual decline through December (bottom chart). Mallard numbers peak in late November/early December and then decline fairly dramatically after the first week of December.



Percent of duck use by week (Ted Shanks CA):
20- year average and 5-year average.

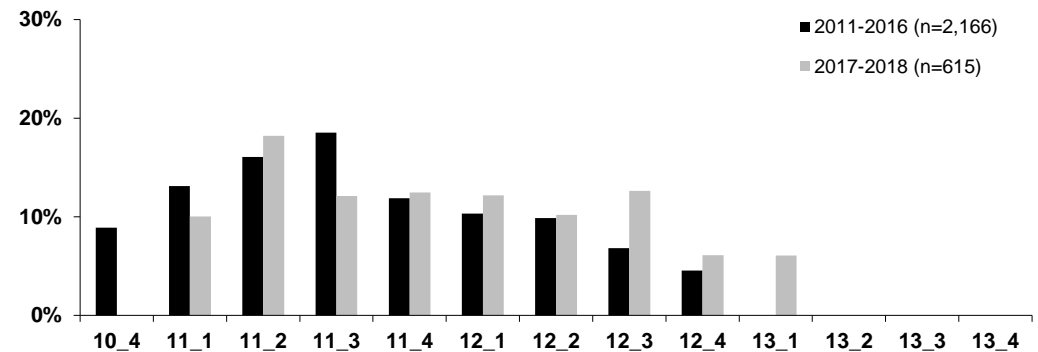


Percent of mallard and early migrant use by week (Ted Shanks CA):
25-year average.

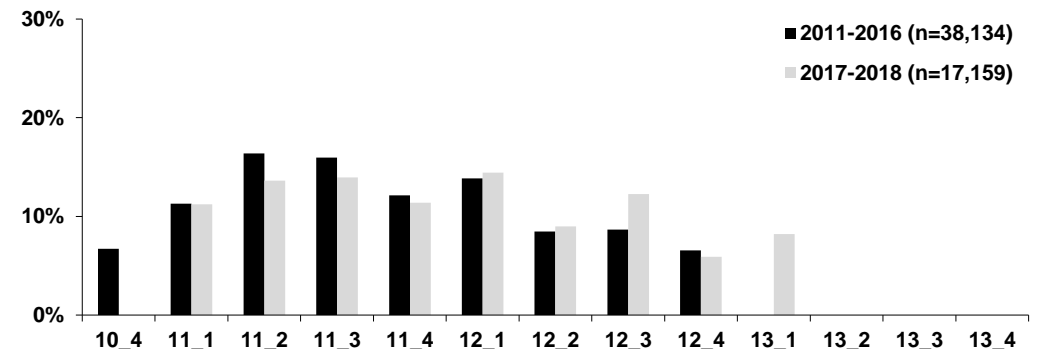


Northeast Harvest: During 2011-2016, excluding opening weekends, the average daily harvest per week steadily increased from the last week in October until peaking in the third week of November and then steadily declined throughout the remainder of the season (top chart). In contrast, harvest in the 2017-2018 period, excluding opening weekends, peaked the second week of November at 18% of total, declined to about 12% of total harvest and remained fairly consistent through the third week of December before declining again for the last two weeks of the season. Average daily harvest per week followed a somewhat similar pattern at Ted Shanks CA with peak harvest occurring during the second and third weeks of November and the first week of December during both time periods (2011-2016 and 2017-2018) (middle chart). Almost 60% of the harvest of species other than mallards occurs through the second week of November (bottom right chart). Mallard harvest remains relatively consistent from the second week of November through the first week of December with 14-18% of the mallard harvest occurring during each of these weeks. Harvest drops off by mid-December (bottom right chart). More mallard band recoveries were reported in November than in December with the peak occurring in the third week in November (bottom left chart).

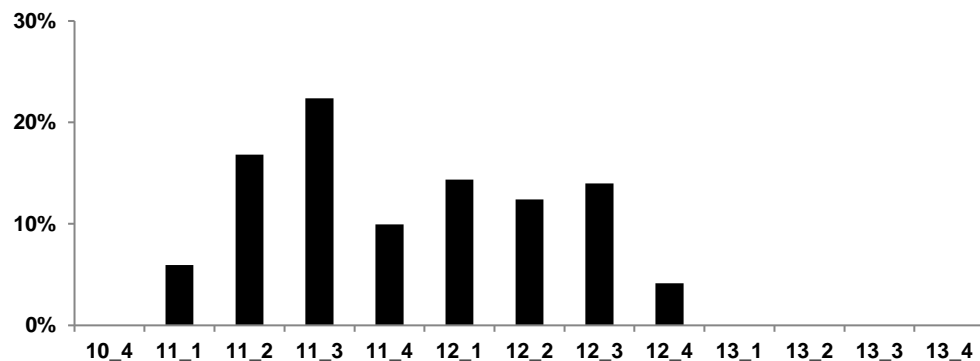
Percent average daily duck harvest per week on public and private ground in the Northeast Region (FWS data).



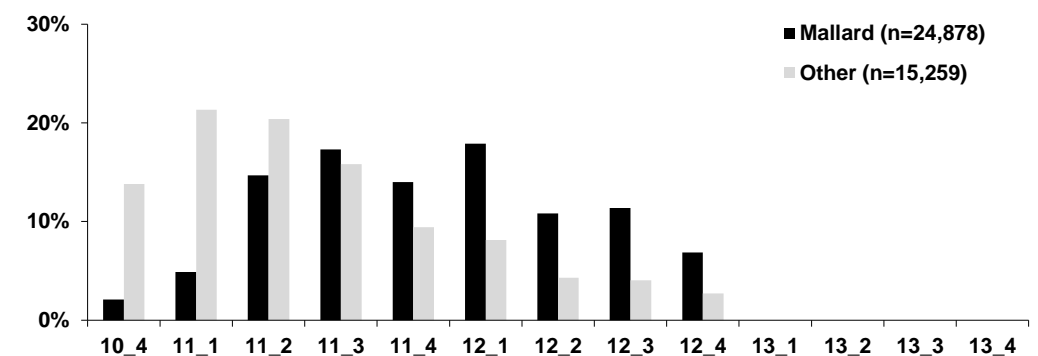
Percent average daily duck harvest per week at Ted Shanks CA.



Percent average daily mallard band recoveries per week in the Northeast Region: 2011-2016 (n=77).



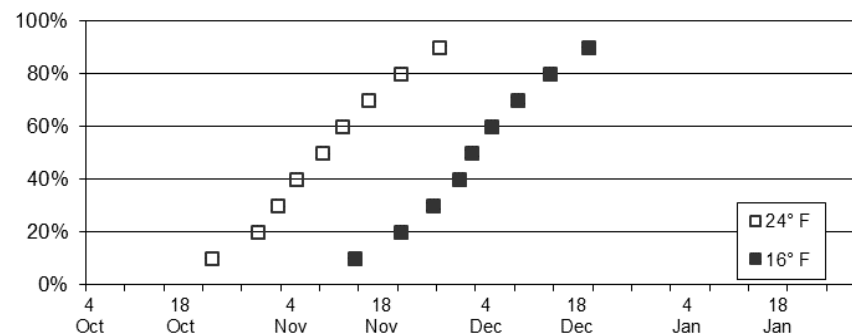
Percent average daily harvest per week of mallards and other ducks at Ted Shanks CA: 2011-2016.



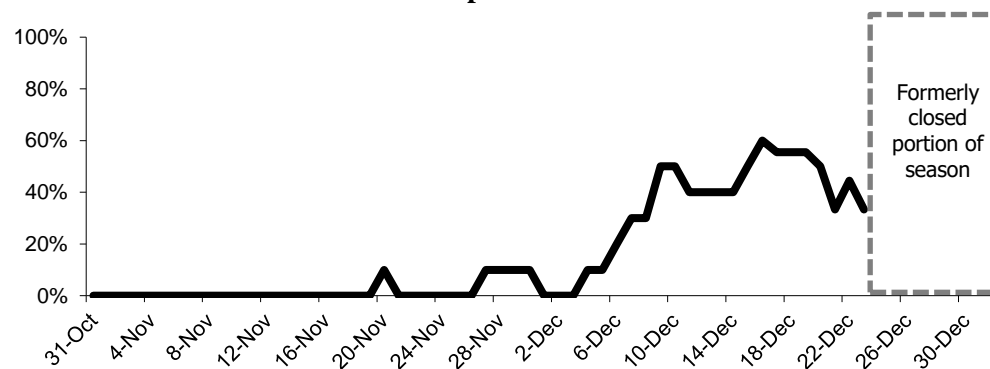
Lincoln Weather: As in the rest of north Missouri, precipitation gradually declines throughout the fall and early winter. On average freezing conditions occur a few days later than in the Northwest Region. There is a 50% probability of seeing a low temperature of 24° F by November 9 that could begin creating skim ice and by December 14 there is an 80% chance of seeing a minimum temperature of 16° F that could produce more substantial ice (top chart). During 2007-2016, B.K. Leach has had ice two or more inches thick by December 16 during four out of the 10 years (middle chart). During the 2007-2016 period, they lost an average of 9.1 days each year to icy conditions and, similarly, during the 2017 and 2018 seasons, they lost an average of 8.5 days (bottom chart).



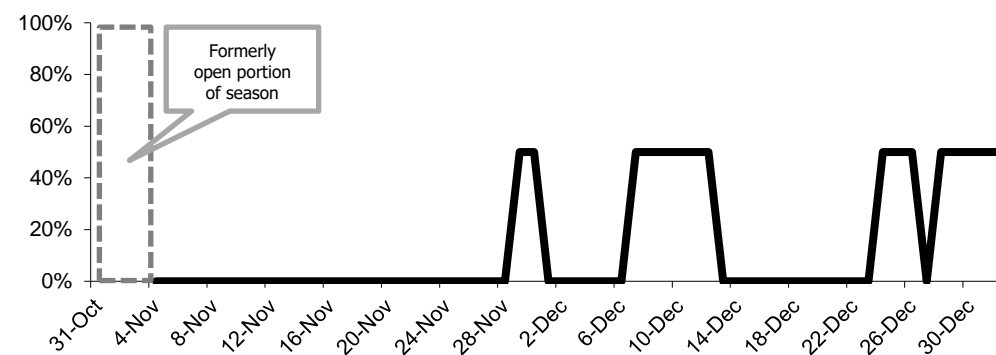
Probability (%) that a temperature of 24° F and 16° F will be reached by date at Elsberry, MO.



Percent of years BK Leach CA had ice > 2 inches throughout the season during the period 2007-2016. The dashed rectangle highlights portion of season closed prior to 2017.

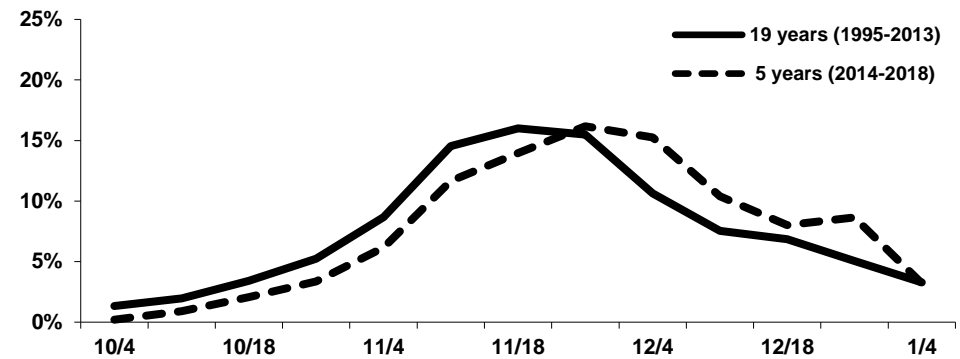


Percent of years BK Leach CA had ice > 2 inches during 2017 and 2018 seasons. The dashed rectangle highlights portion of season open prior to 2017.

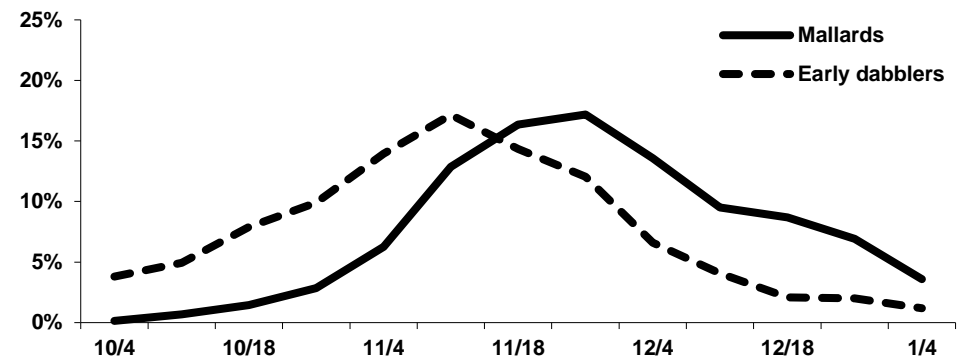


Lincoln Migration Timing: Duck numbers gradually increase throughout October and November before peaking in late November. They then decline throughout December and the beginning of January. The timing of peak numbers was a week later during the most recent five years compared to the previous 20-years (top chart). Fewer ducks have been present in October during the last five years compared to the previous 20 years and more ducks have been present in December in recent years. Early season migrant use builds to early November and then steadily declines throughout the remainder of November and December (bottom chart). Mallard numbers peak in late November/early December and then steadily decline after the first week of December.

**Percent of duck use by week (B.K. Leach CA and Clarence Cannon NWR):
19- year average and 5-year average.**

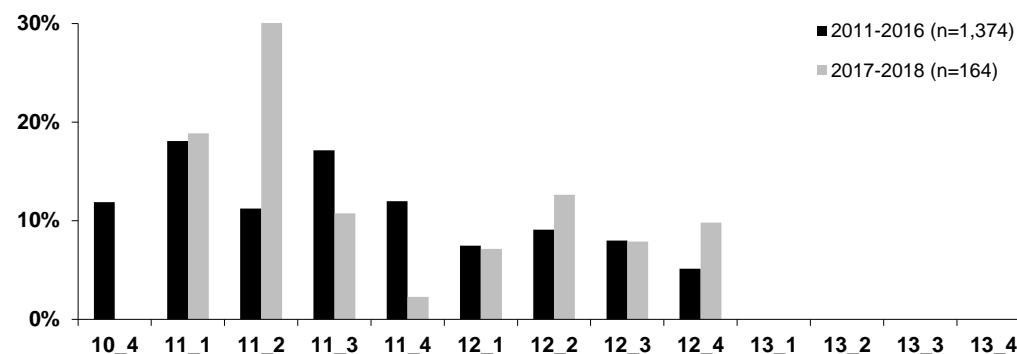


Percent of mallard and early migrant use by week (B.K. Leach CA and Clarence Cannon NWR): 25-year average.

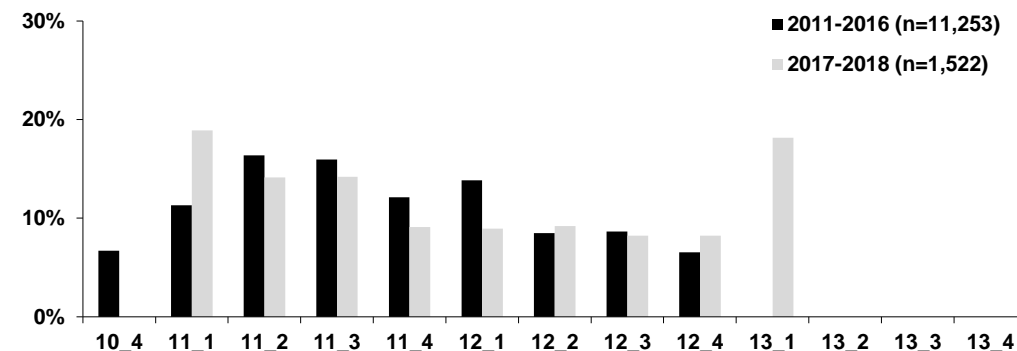


Lincoln Harvest: In 2011-2016, excluding opening weekends, approximately 30% of the total harvest for this region occurred during the last week of October and first week of November, compared to 13% during the last two weeks in December. Fifty-eight percent of the average daily harvest occurred in November compared to 31% in December in 2011-2016. In 2017-2018, excluding opening weekends, the November versus December comparison was 63% versus 37%. On B.K. Leach CA during 2011-2016, excluding opening weekends, harvest peaked at approximately 16% of the season total during the second and third weeks of November and ranged from 7 to 14% of total harvest during each of the remaining weeks. In contrast, 2017-2018 saw the peak harvest of approximately 19% of total harvest occurring in the first week of November (first week of season) and 18% occurred during the first week of January (last week of season, middle chart). On B.K. Leach CA, 37% of other ducks are harvested through the first week of November (bottom right chart). Mallard harvest peaks the third week of November and slowly declines through the remainder of the season. Mallard band recoveries peaked during the fourth week of December in this region (bottom left chart).

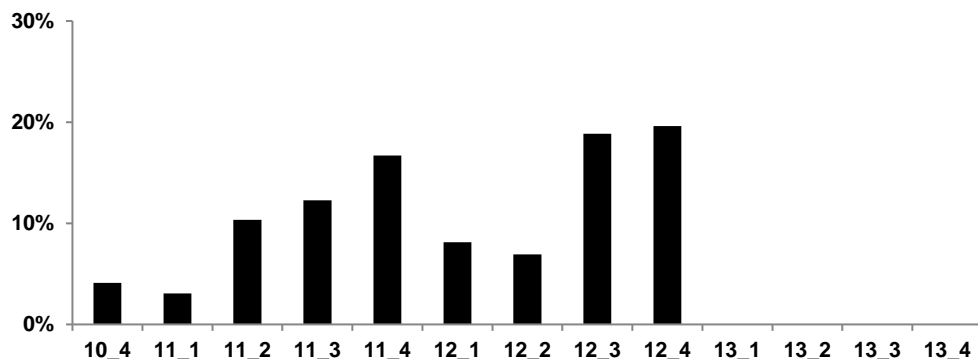
Percent average daily duck harvest per week on public and private ground in the Lincoln Region (FWS data).



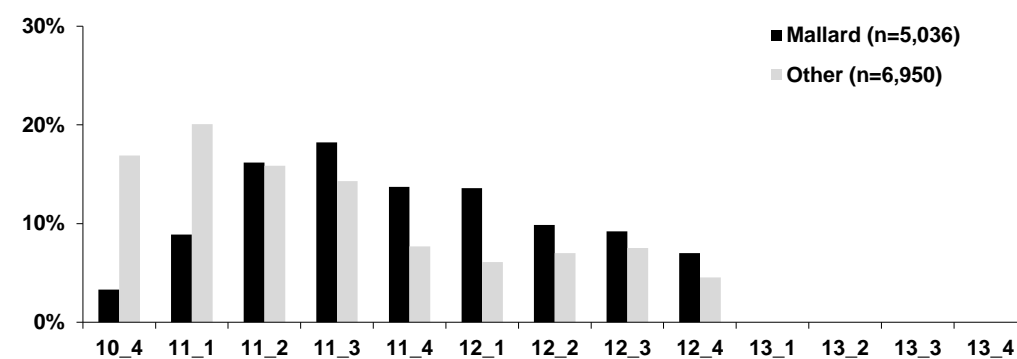
Percent average daily duck harvest per week at B. K. Leach CA.



Percent average daily mallard band recoveries per week in the Lincoln Region: 2011-2016 (n=73).



Percent average daily harvest per week of mallards and other ducks at B. K. Leach CA: 2011-2016.

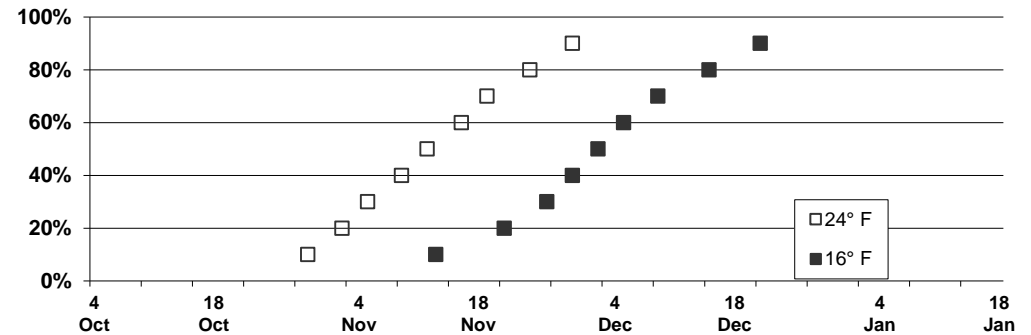


Missouri River West

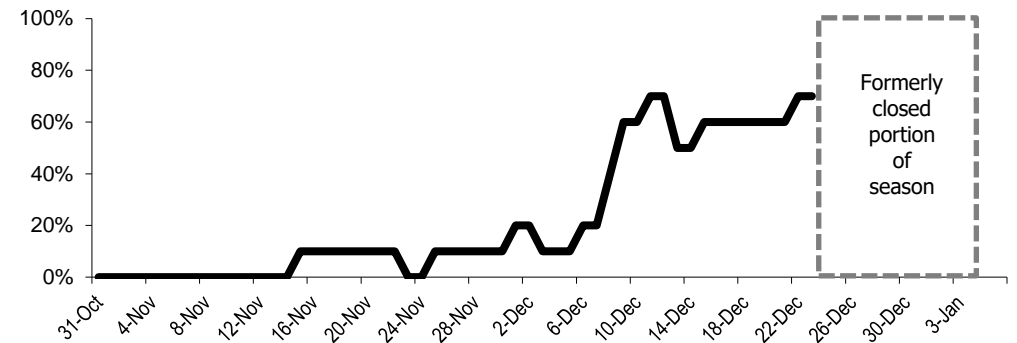
Missouri River West Weather: Precipitation patterns in the Missouri River West Region are similar to Northwest Missouri. On average, freezing conditions occur a few days later than in the Northwest Region and a few days earlier than in the Northeast Region. There is a 50% probability of seeing a low temperature of 24° F by November 12, and by December 2 there is a 50% chance of seeing a minimum temperature of 16° F (top chart). During 2007-2016, Grand Pass CA has had ice two or more inches thick by December 16 in 60% of the years (middle chart). Grand Pass CA has lost an average of 14 days of hunting due to ice each of these years whereas they lost an average of 17 days to ice during the 2017 and 2018 seasons (bottom chart).



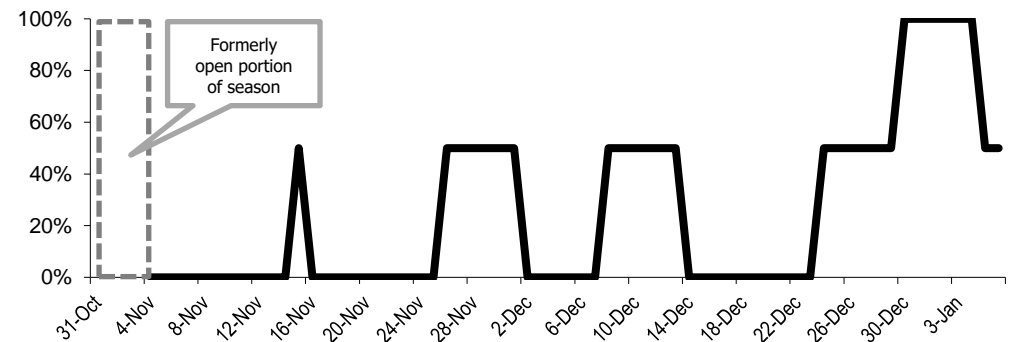
Probability (%) that a temperature of 24° F and 16° F will be reached by date at Marshall, MO.



Percent of years Grand Pass CA had ice > 2 inches throughout the season during the period 2007-2016. The dashed rectangle highlights portion of season closed prior to 2017.

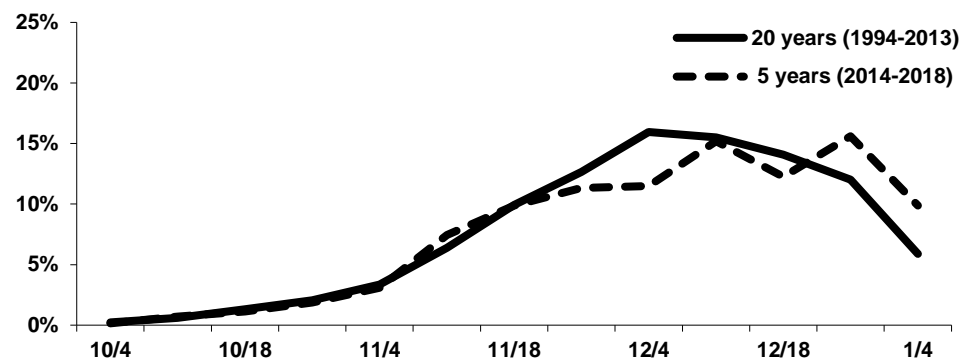


Percent of years Grand Pass CA had ice > 2 inches during 2017 and 2018 seasons. The dashed rectangle highlights portion of season open prior to 2017.

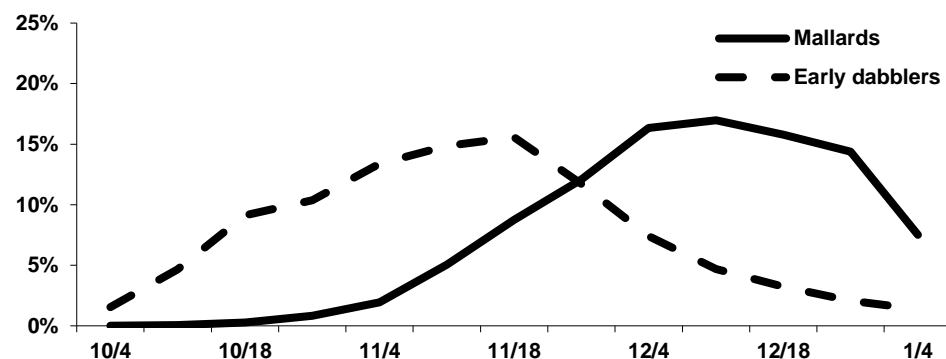


Missouri River West Migration Timing: Peak migration as illustrated by the 20-year average occurred the first week in December (top chart). During the last five years, Grand Pass CA reached peak numbers during the second week of December and maintained these numbers through the fourth week of December. Numbers declined thereafter. Early dabbler use builds in late October and remains consistent until mid-November when early season migrant numbers decline, and mallard numbers increase (bottom chart). Late season use associated with Grand Pass CA and the Missouri River is apparent in this region.

**Percent of duck use by week (Grand Pass CA):
20- year average and 5-year average.**

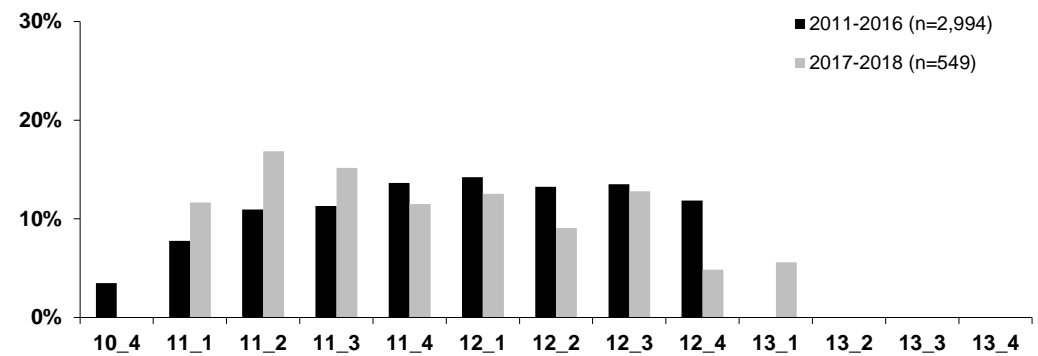


**Percent of mallard and early migrant use by week (Grand Pass CA):
25-year average.**

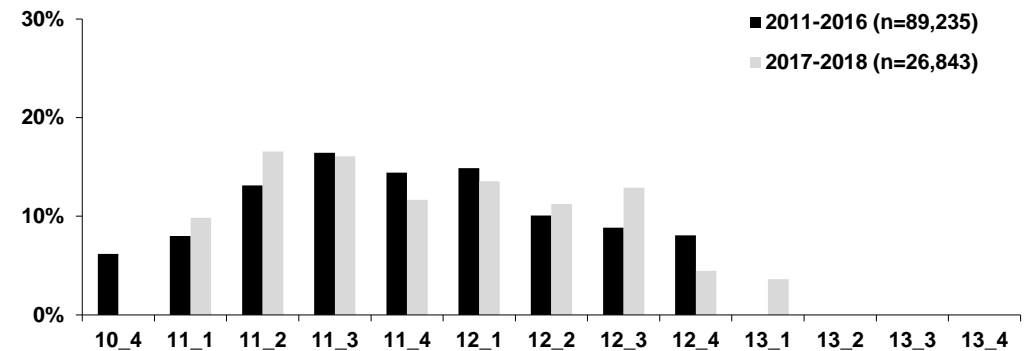


Missouri River West Harvest: During 2011-2016, excluding opening weekends, harvest in this region generally peaked in late November and early to mid-December and remained high through the fourth week in December as indicated by FWS harvest estimates (top chart). During 2011-2016, 44% of total average daily harvest at Grand Pass CA occurred during November and 53% occurred during December (middle chart). Harvest of early migrants at Grand Pass CA was relatively consistent through the third week of November with approximately 15-18% of the season totals occurring each week (bottom right chart). Mallard harvest steadily increases through November, peaks the first week in December and then gradually declines. Mallard band recoveries in the region reflect a similar pattern with peak recoveries reported the fourth week of November (bottom left chart).

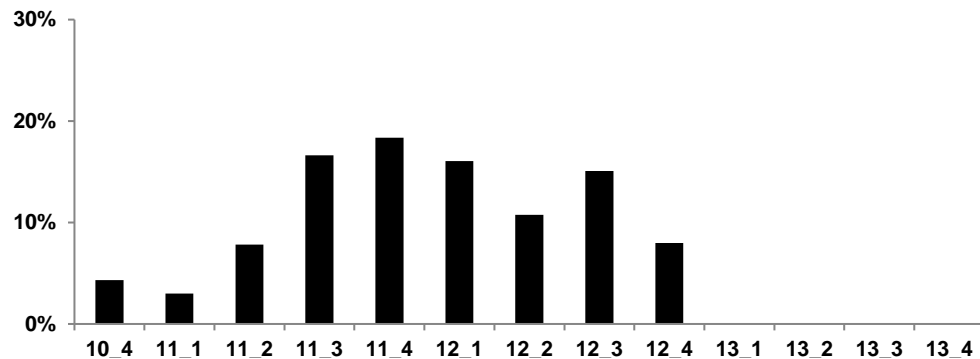
Percent average daily duck harvest per week on public and private ground in the Missouri River West Region (FWS data).



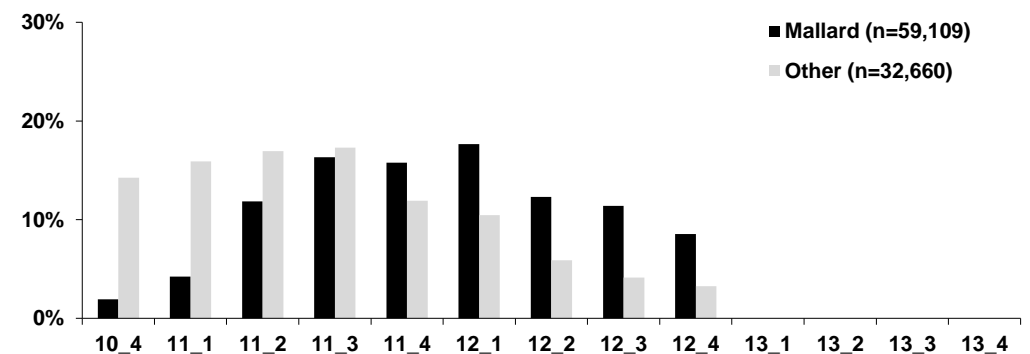
Percent average daily duck harvest per week at Grand Pass CA.



Percent average daily mallard band recoveries per week in the Missouri River West Region: 2011-2016 (n=165).

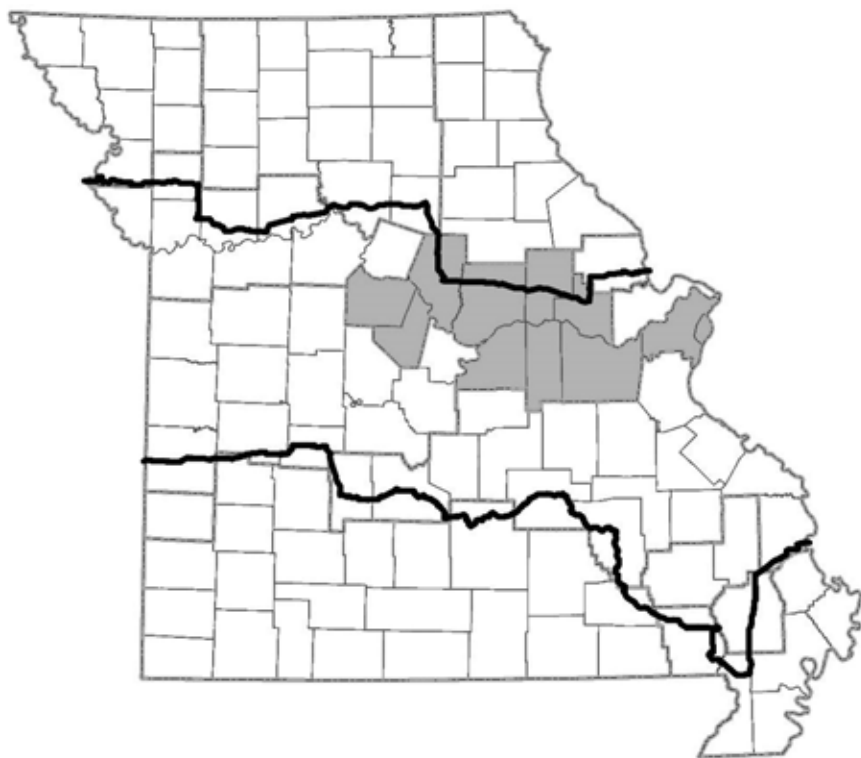


Percent average daily harvest per week of mallards and other ducks at Grand Pass CA: 2011-2016.

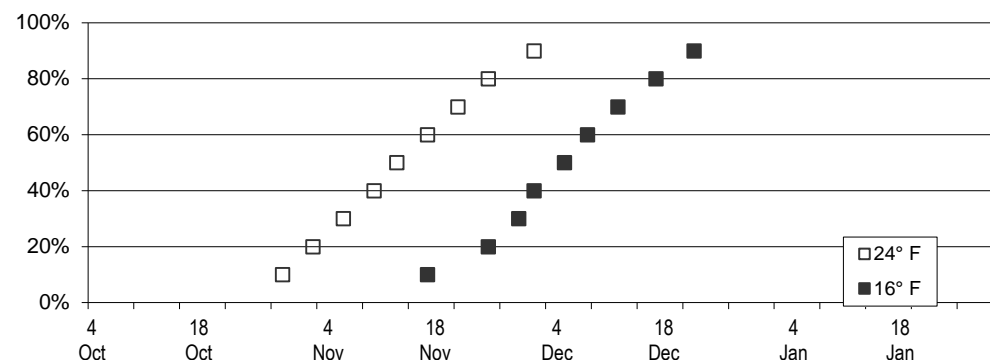


Missouri River East

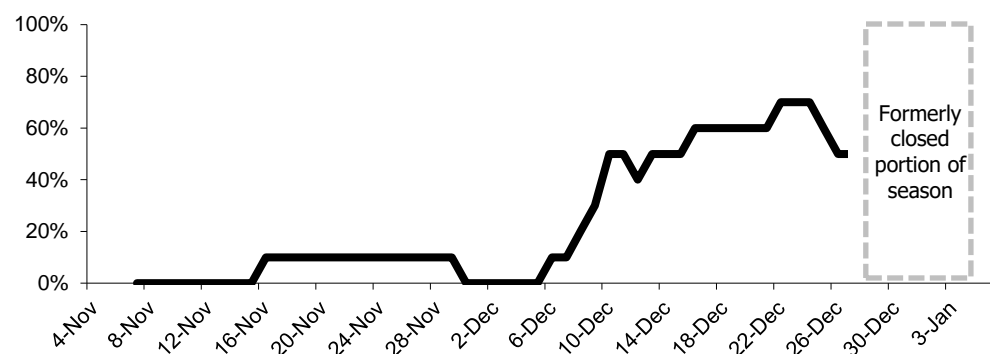
Missouri River East Weather: Precipitation patterns in the Missouri River East Region are similar to those found in the Missouri River West Region. There is a 50% probability of seeing a low temperature of 24° F by November 14, and by December 5 there is a 50% chance of seeing a minimum temperature of 16° F. During 2007-2016, Eagle Bluffs CA has had ice two or more inches thick by December 17 in about 60% of the years (middle chart). Eagle Bluffs CA averaged about 14 days of hunting lost to ice each year during these ten years whereas they lost an average of 7.5 days to ice in the 2017 and 2018 seasons (bottom chart).



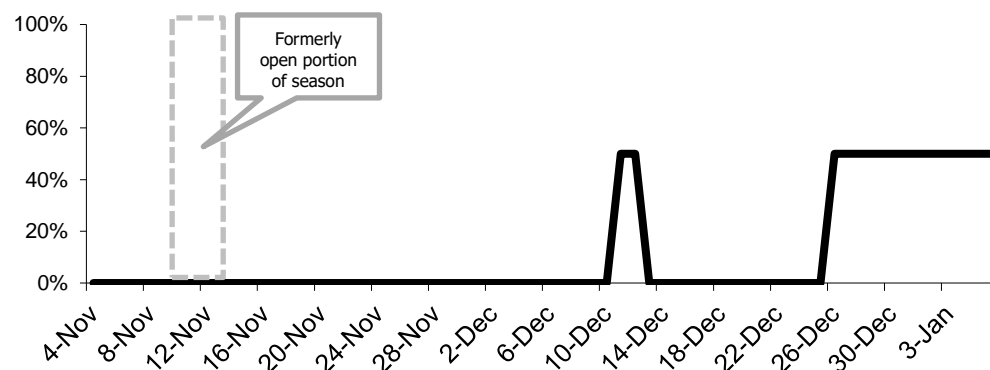
Probability (%) that a temperature of 24° F and 16° F will be reached by date at Columbia, MO.



Percent of years Eagle Bluffs CA had ice > 2 inches throughout the season during the period 2007-2016. The dashed rectangle highlights portion of season closed prior to 2017.

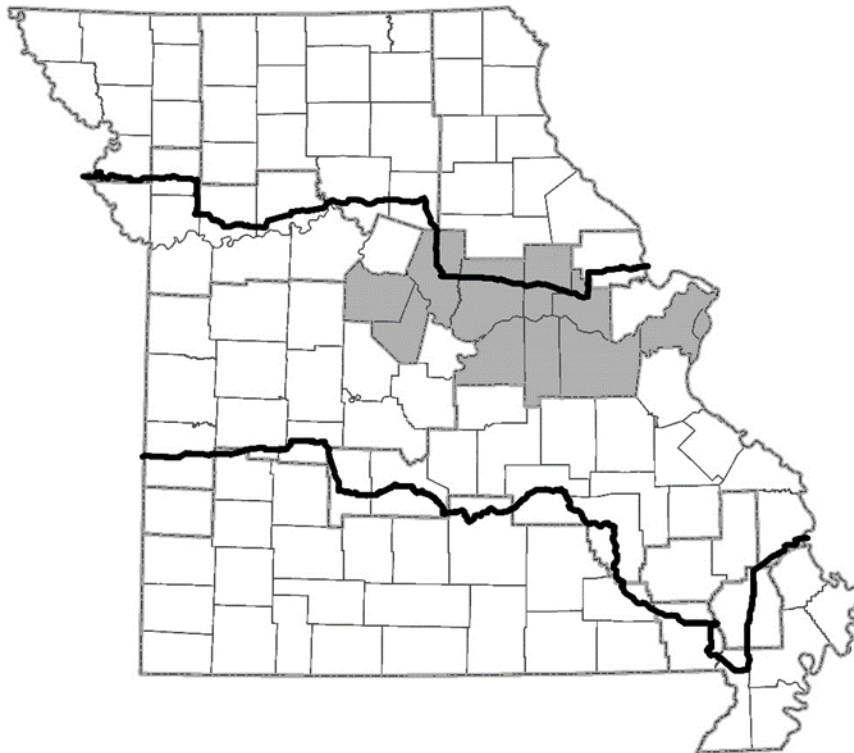
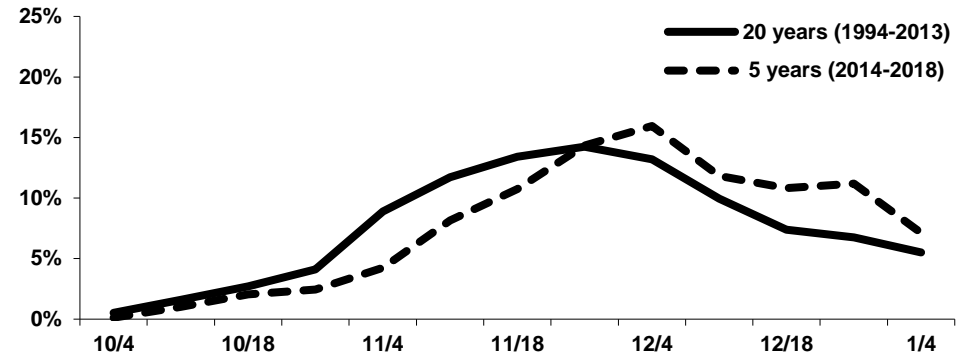


Percent of years Eagle Bluffs CA had ice > 2 inches during 2017 and 2018 seasons. The dashed rectangle highlights portion of season open prior to 2017.

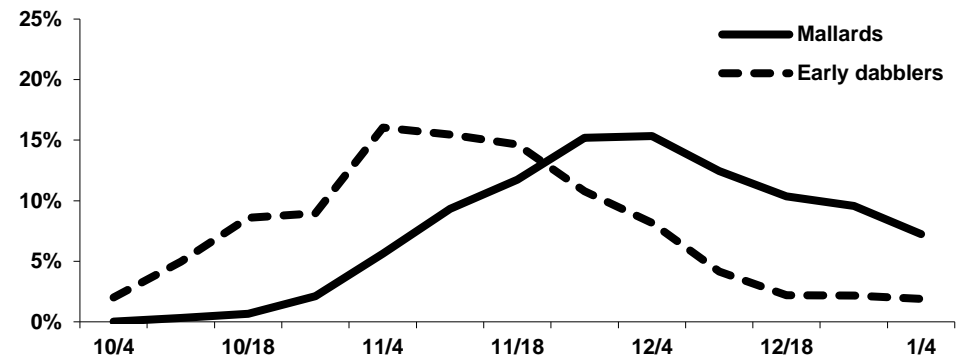


Missouri River East Migration Timing: Peak duck abundance occurs around the last week in November and first week in December (top chart). In the most recent five years, peak numbers have arrived about a week later than during the previous 20 years with fewer ducks present during November and more present during December. Early dabbler use typically peaks the first week in November and declines fairly rapidly thereafter, while mallard numbers continue to increase until they peak in late November/early December (bottom chart).

Percent of duck use by week (Eagle Bluffs CA):
20- year average and 5-year average.

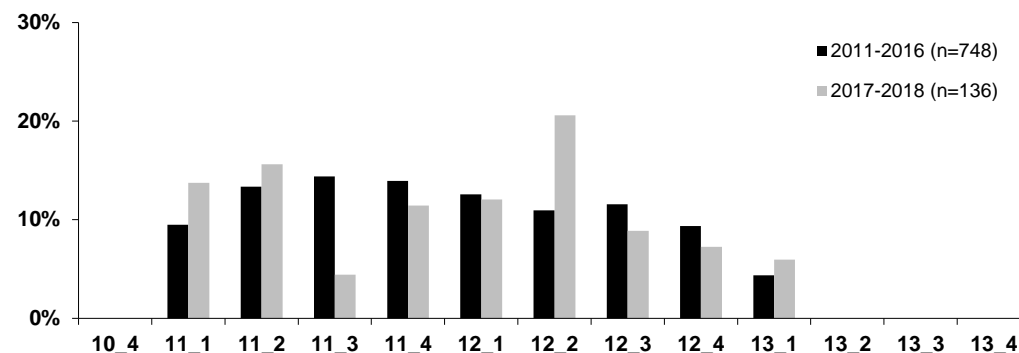


Percent of mallard and early migrant use by week (Eagle Bluffs CA):
25-year average.

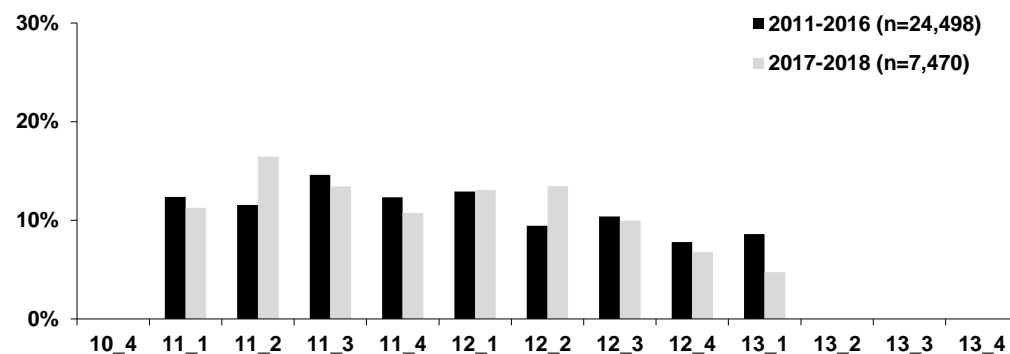


Missouri River East Harvest: During 2011-2016, excluding opening weekends, 22% of the total average daily harvest occurred during the first two weeks of November compared to 13% during the last week in December and first week in January. During 2017 and 2018, 29% versus 13% occurred during these early and late season periods (top chart). During the 2017-2018 seasons, harvest peaked during the second week of December. Average daily harvest per week peaked at Eagle Bluffs CA the third week of November during 2011-2016 whereas peak average daily harvest for 2017-2018 occurred the second week of November (middle chart). Harvest of species other than mallard peaks on Eagle Bluffs CA during the first week of November (bottom right chart). Mallard harvest is relatively steady through November and December at Eagle Bluffs. Mallard band recoveries suggest slightly higher mallard harvest the third week in December and first week in January (bottom left chart).

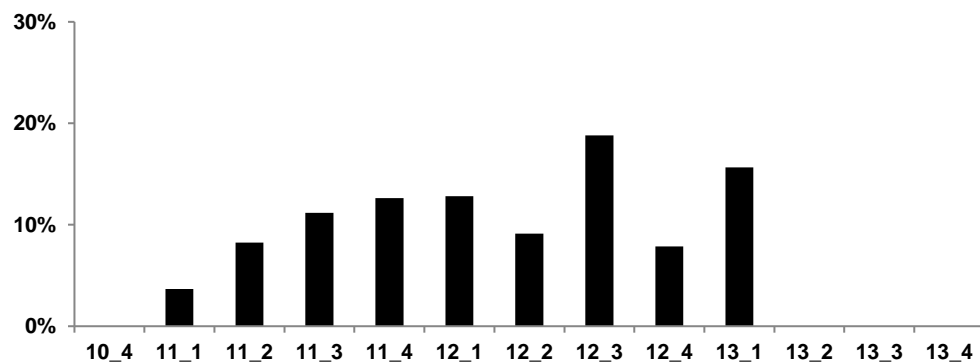
Percent average daily duck harvest per week on public and private ground in the Missouri River East Region (FWS data).



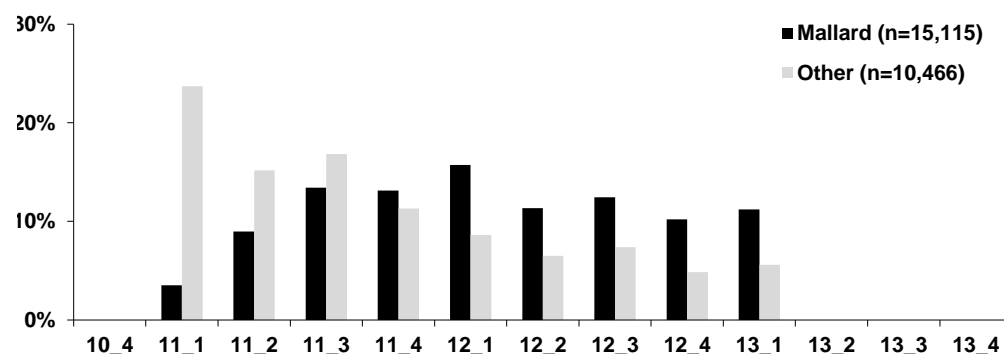
Percent average daily duck harvest per week at Eagle Bluffs CA.



Percent average daily mallard band recoveries per week in the Missouri River East Region: 2011-2016 (n=49).



Percent average daily harvest per week of mallards and other ducks at Eagle Bluffs CA: 2011-2016.

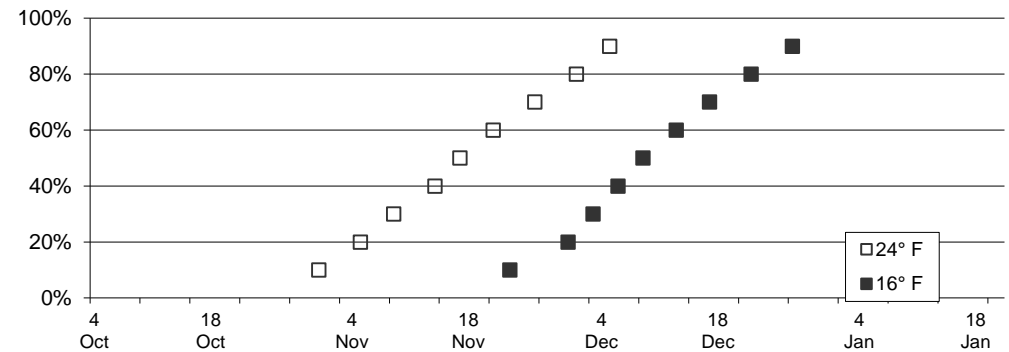


St. Charles

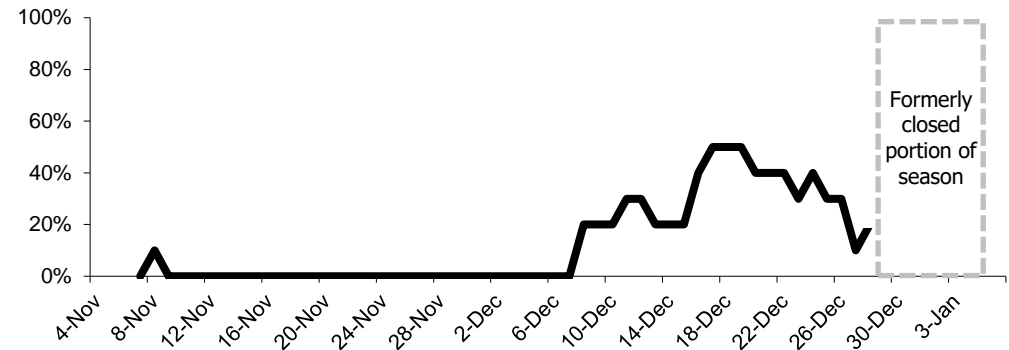
St. Charles Weather: As in the rest of north Missouri, precipitation gradually declines throughout the fall and early winter. On average freezing conditions occur a few days later than in the Northwest Region. There is a 50% probability of seeing a low temperature of 24° F by November 17 that could begin creating skim ice and by December 9 there is a 50% chance of seeing a minimum temperature of 16° F that could produce more substantial ice (top chart). Columbia Bottom CA has had ice two or more inches thick by December 17 five out of ten years from 2007-2016 (middle chart). Over this same time span, Columbia CA has been frozen up for an average of 8 days each season whereas they lost an average of 6 days during the 2017 and 2018 seasons (bottom chart).



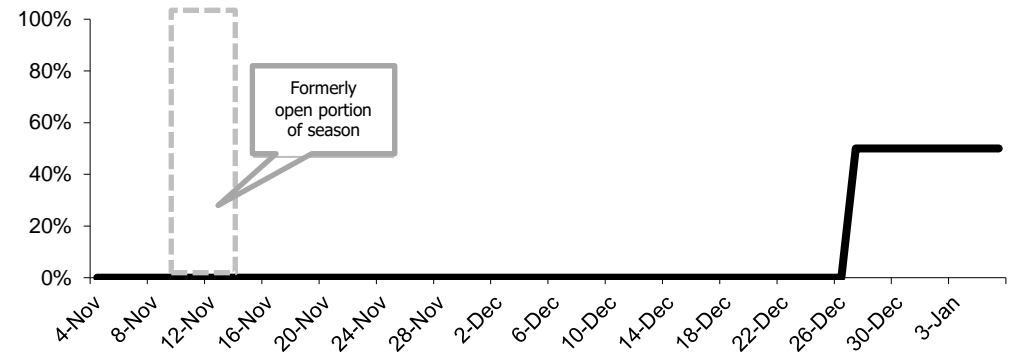
Probability (%) that a temperature of 24° F and 16° F will be reached by date at St. Charles, MO.



Percent of years Columbia Bottom CA had ice > 2 inches during the period 2007-2016. The dashed rectangle highlights portion of season closed prior to 2017.

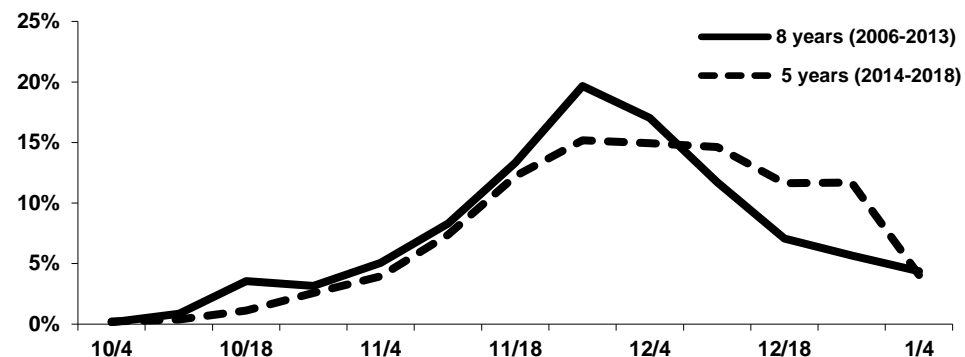


Percent of years Columbia Bottom CA had ice > 2 inches during 2017 and 2018 seasons. The dashed rectangle highlights portion of season open prior to 2017.

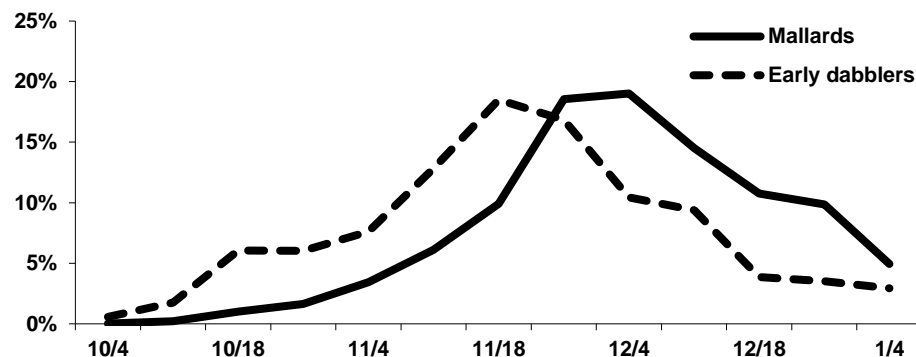


St. Charles Migration Timing: Data on duck use is relatively limited in this region so comparison is made between the 8-year and 5-year average based on data from Columbia Bottom CA. The 8-year average suggests duck numbers build quickly to a peak in late November before experiencing an equally sharp decline through December (top chart). The 5-year average of duck use by week suggests that once ducks arrive, they have tended to stay longer into December with close to peak numbers remaining from early through mid-December. The peak for early migrants occurs in mid-November and declines steadily thereafter (lower chart). Mallard numbers peak in late November/early December and then decline through December (bottom chart).

**Percent of duck use by week (Columbia Bottom CA):
8- year average and 5-year average.**

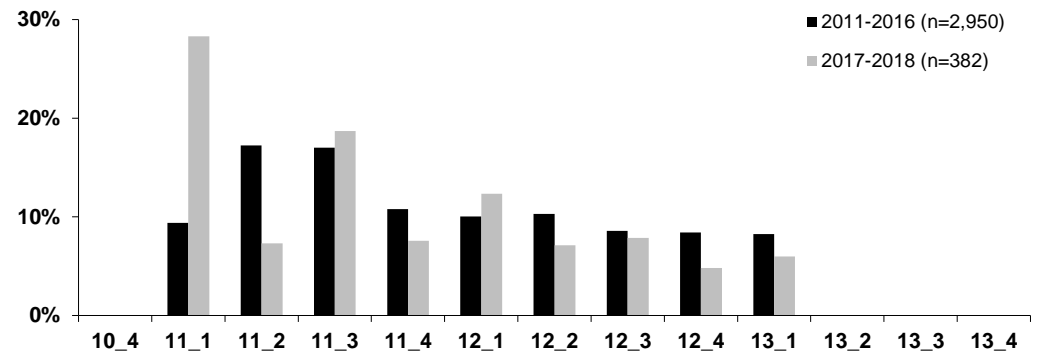


**Percent of mallard and early migrant use by week (Columbia Bottom CA):
8-year average.**

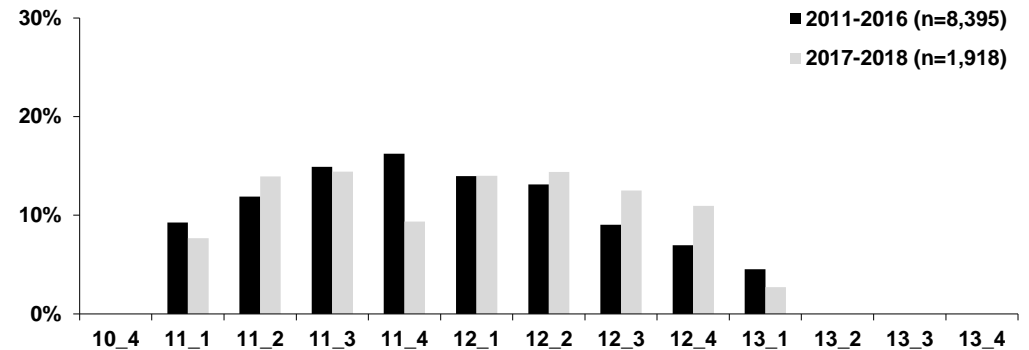


St. Charles Harvest: During 2011-2016, excluding opening weekends, average daily harvest on public and private ground peaked during the second and third weeks of November with about 34% of the season total occurring; harvest varied from 8 to 11% of total in each of the other weeks in the season (top chart). In contrast, during 2017-2018, excluding opening weekend and the first day of the second segment, average daily harvest peaked at 28% of total during the first week of November. At Columbia Bottom CA (2011-2016), harvest steadily increased to a peak of 16% of the total during the fourth week of November and steadily declined thereafter (middle chart). Columbia Bottom CA hunters harvest the most species other than mallards during November (bottom right chart). At Columbia Bottom CA, mallard harvest steadily increases through November, peaks the fourth week of November and first week of December before steadily declining thereafter. FWS mallard band recoveries suggest a slightly different harvest pattern as mallard band recoveries peak in mid-November with another another in mid- to late December and early January (bottom left chart).

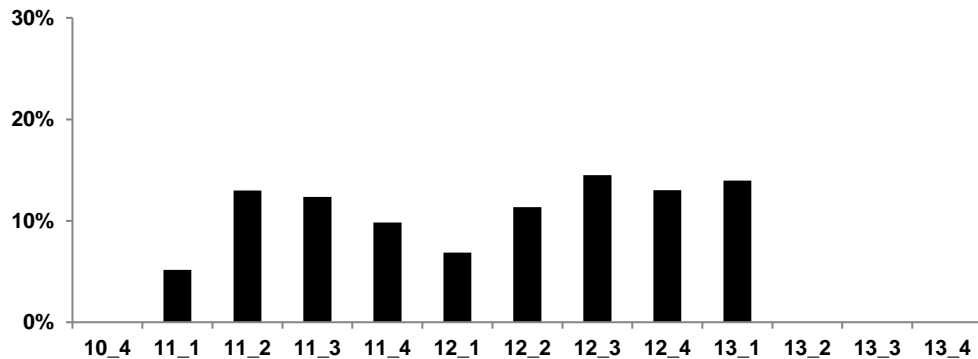
Percent average daily duck harvest per week on public and private ground in the St. Charles Region (FWS data).



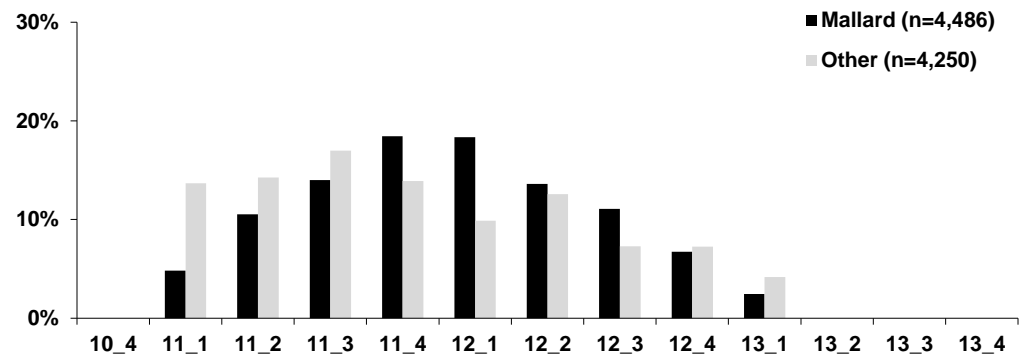
Percent average daily duck harvest per week at Columbia Bottom CA.



Percent average daily mallard band recoveries per week in the St. Charles Region: 2011-2016 (n=176).

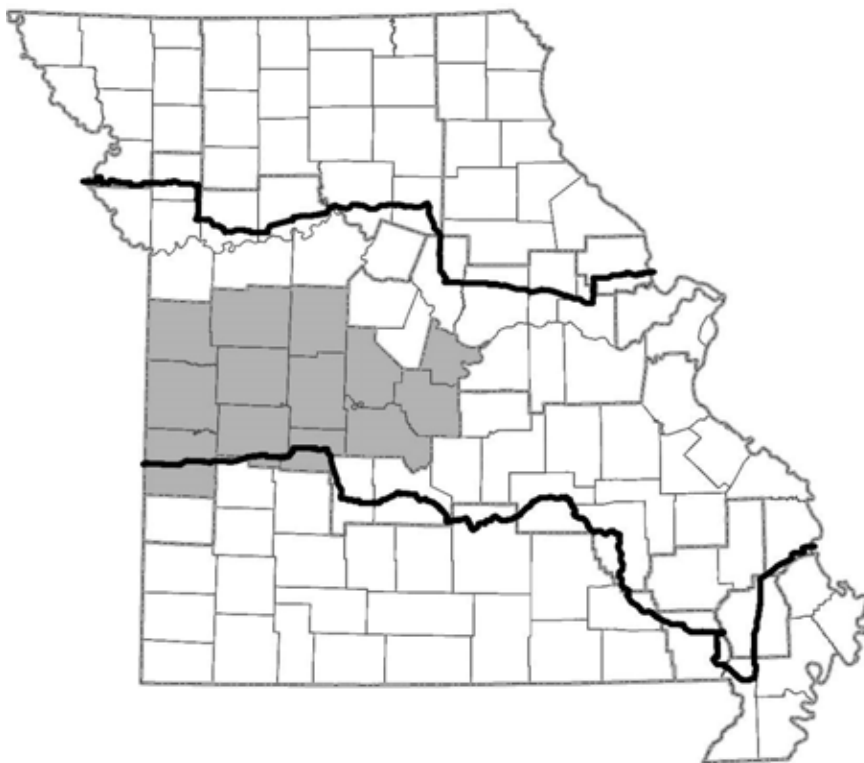


Percent average daily harvest per week of mallards and other ducks at Columbia Bottom CA: 2011-2016.

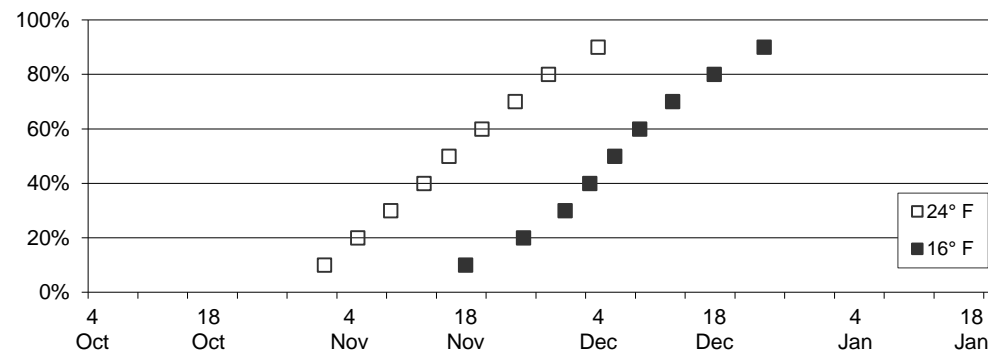


West Central

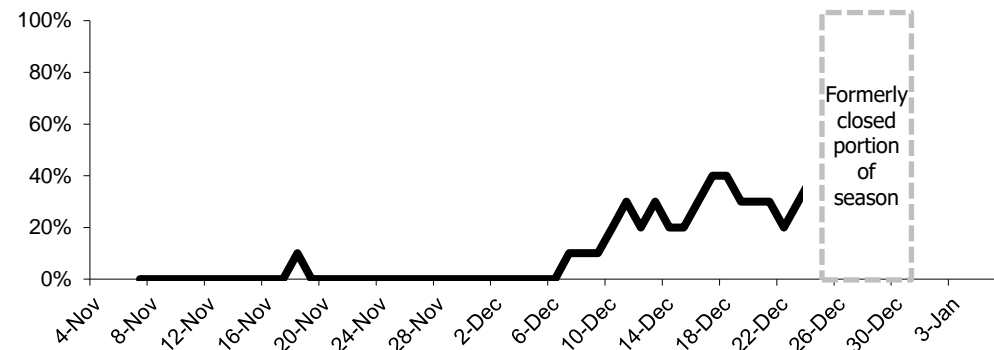
West Central Weather: Higher mean precipitation is sustained later into the fall in West Central Missouri than in the northern Missouri, and average low temperatures occur a few days later. A 50% probability of seeing a low temperature of 24° F occurs by November 13, and a 50% chance of temperatures dropping to 16°F occurs by December 3 (top chart). Over the ten years from 2007-2016, this region has experienced a pattern of freezing and thawing. For example, Four Rivers CA has had ice two or more inches thick on December 26 in 50% of these years and only 30% of the time on December 26 (middle chart). During the past 12 years, Four Rivers CA was frozen an average of seven days each season including the 2017 and 2018 seasons (bottom chart).



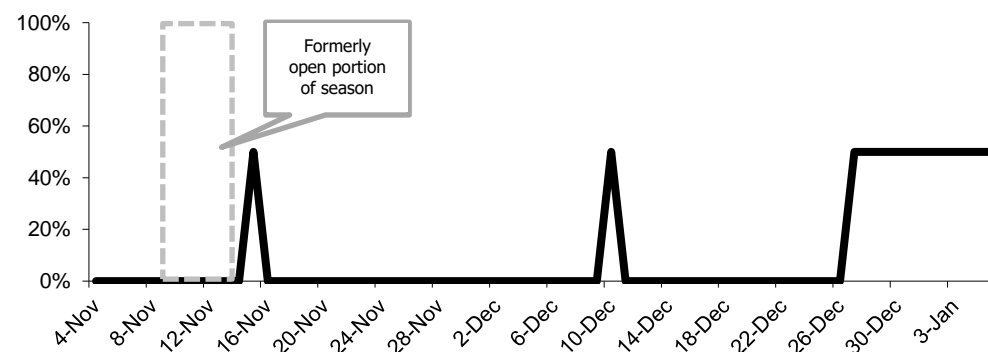
Probability (%) that a temperature of 24° F and 16° F will be reached by date at Appleton City, MO.



Percent of years Four Rivers CA had ice > 2 inches throughout the season during the period 2007-2016. The dashed rectangle highlights portion of season closed prior to 2017.

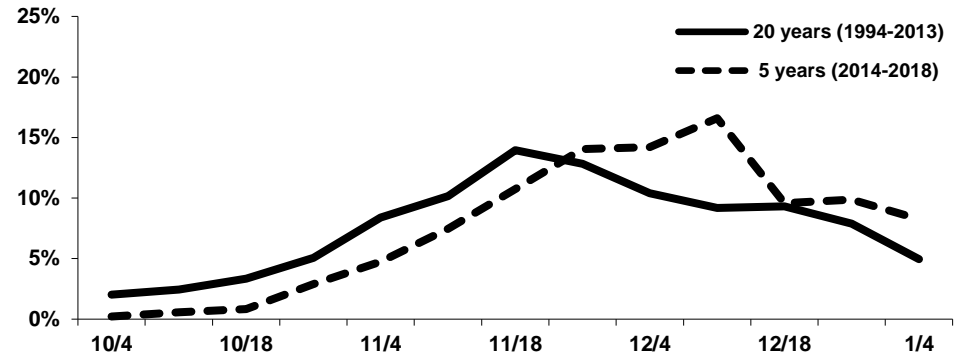


Percent of years Four Rivers CA had ice > 2 inches during 2017 & 2018 seasons. The dashed rectangle highlights the split employed in the 2017 and 2018 seasons.

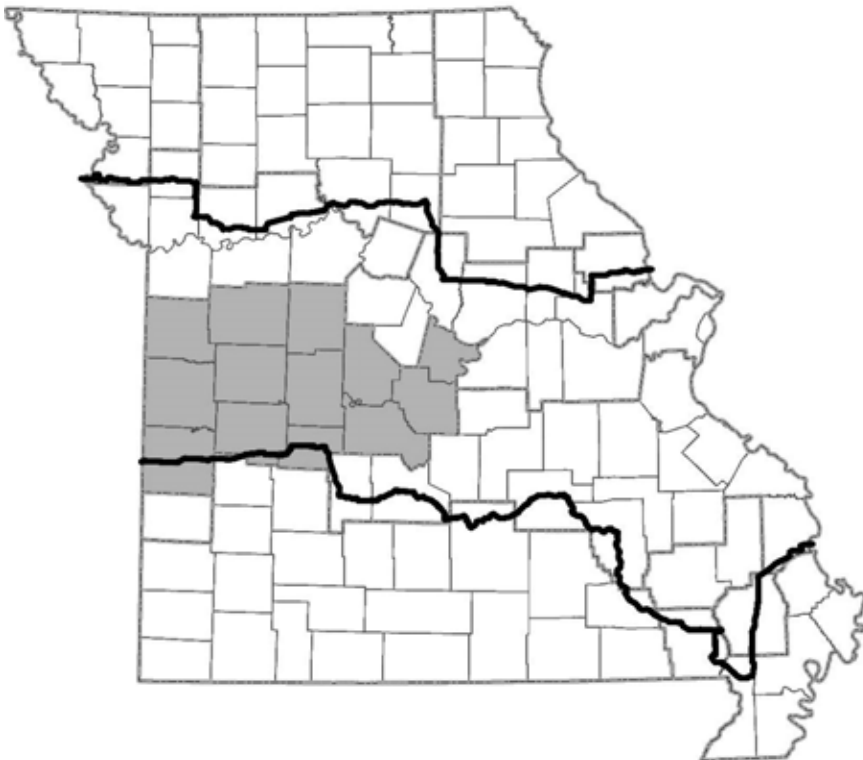
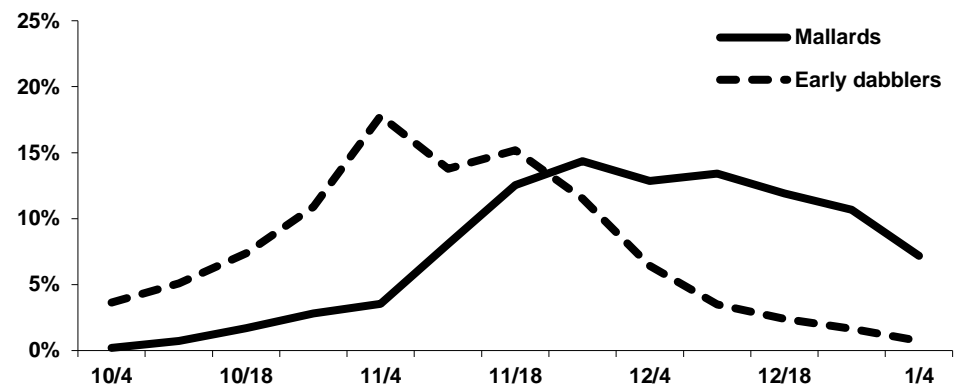


West Central Migration Timing: Duck migration over the past five years appears to be later than the previous twenty years (top chart). Previously duck number tended to gradually build through October and peak during the third week in November. In recent years a lower percent of the total ducks have been present in October. The timing of peak migration has also shifted later from mid-November during 1994-2013 to the second week in December during 2014-2018. Peak numbers of early season migrants are present by the first week in November and decline relatively sharply thereafter (middle chart). Mallard numbers typically build throughout November with a relatively flat curve through mid-December before beginning to decline late in the season.

**Percent of duck use by week (Four Rivers CA):
20- year average and 5-year average.**

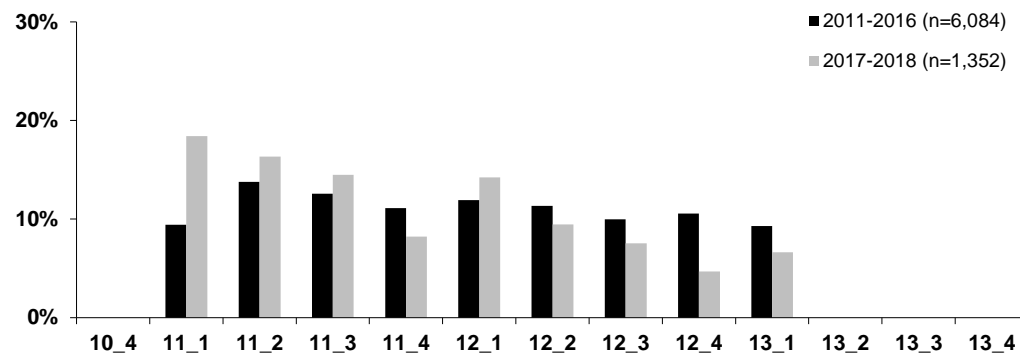


Percent of mallard and early migrant use by week (Four Rivers CA): 25-year average.

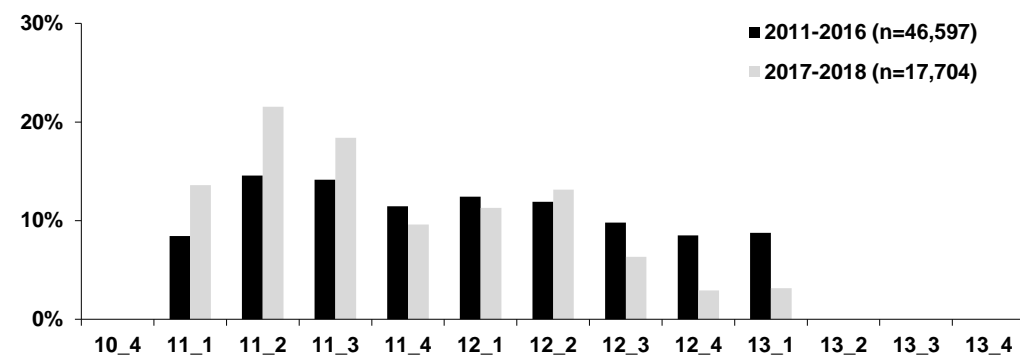


West Central Harvest: During 2011-2016, excluding opening weekends, peak harvest occurred the second week of November and remained steady through the remainder of the season (top chart). During 2017-2018, excluding opening weekends and the first day of the second segment, public and private land hunters harvested 57% of the total average daily harvest during November and 35% during December. Average daily harvest at Four Rivers CA peaked the second and third week of November during 2011-2016 and then remained relatively constant through the remainder of the season (middle chart). During 2017-2018, hunters at Four Rivers CA harvested 36% of the total average daily harvest during the first two weeks of November and 6% during the last week of December and first week of January. Hunters at Four Rivers harvested almost 54% of ducks other than mallards through the first three weeks of November (bottom right chart). Mallard harvest remained relatively consistent at 11-13% of the total from the second week of November through the end of the season. The number of mallard band recoveries also remains fairly constant through much of the season (bottom left chart).

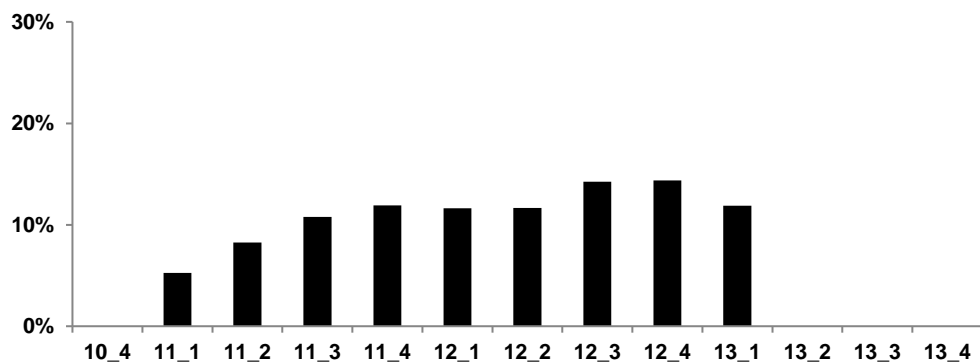
Percent average daily duck harvest per week on public and private ground in the West Central Region (FWS data).



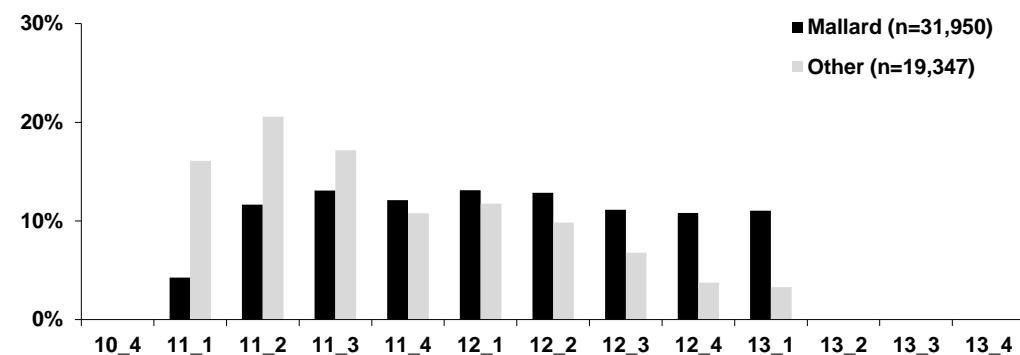
Percent average daily duck harvest per week at Four Rivers CA.



Percent average daily mallard band recoveries per week in the West Central Region: 2011-2016 (n=289).



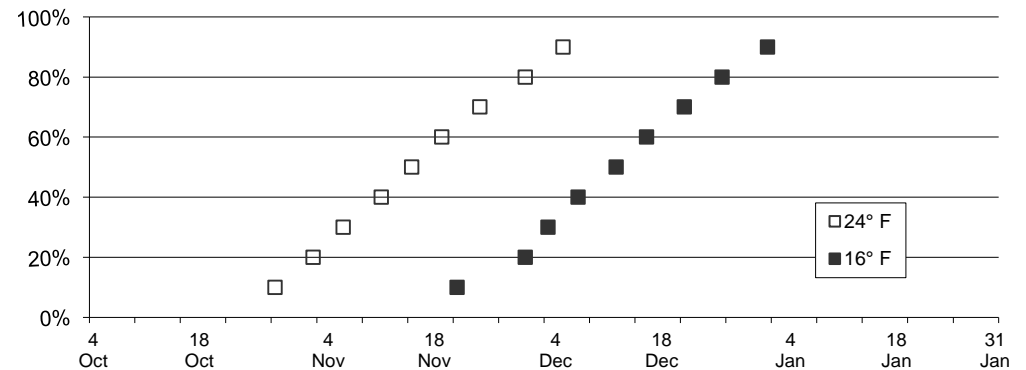
Percent average daily harvest per week of mallards and other ducks at Four Rivers CA: 2011-2016.



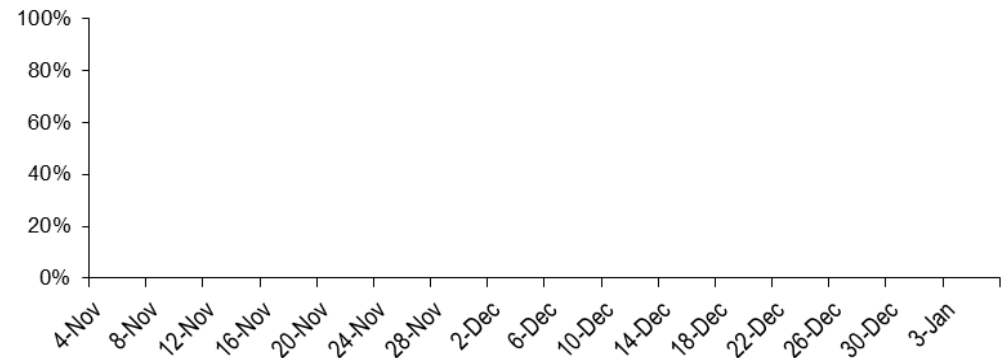
East Central

East Central Weather: On average, there is little change from early fall through early December in the amount of precipitation received in this region. Although backwaters and floodplain depressions freeze by mid-December, rivers remain open through December in most years. There is a 50% probability of seeing a temperature as low as 24° F by November 15, and 16° F by December 12 (top chart). No intensively managed wetland areas are located in this region so there is no available date on ice conditions.

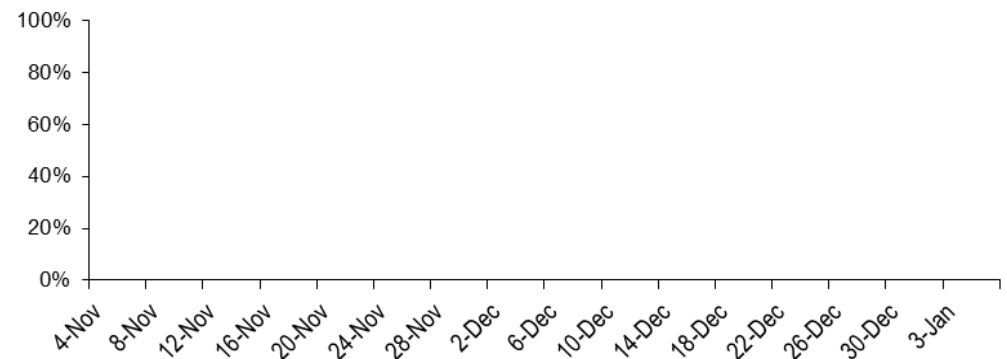
Probability (%) that a temperature of 24° F and 16° F will be reached by a certain date at Cape Girardeau, MO.



**No intensively managed wetland area located in the East Central region.
No available data on ice conditions.**

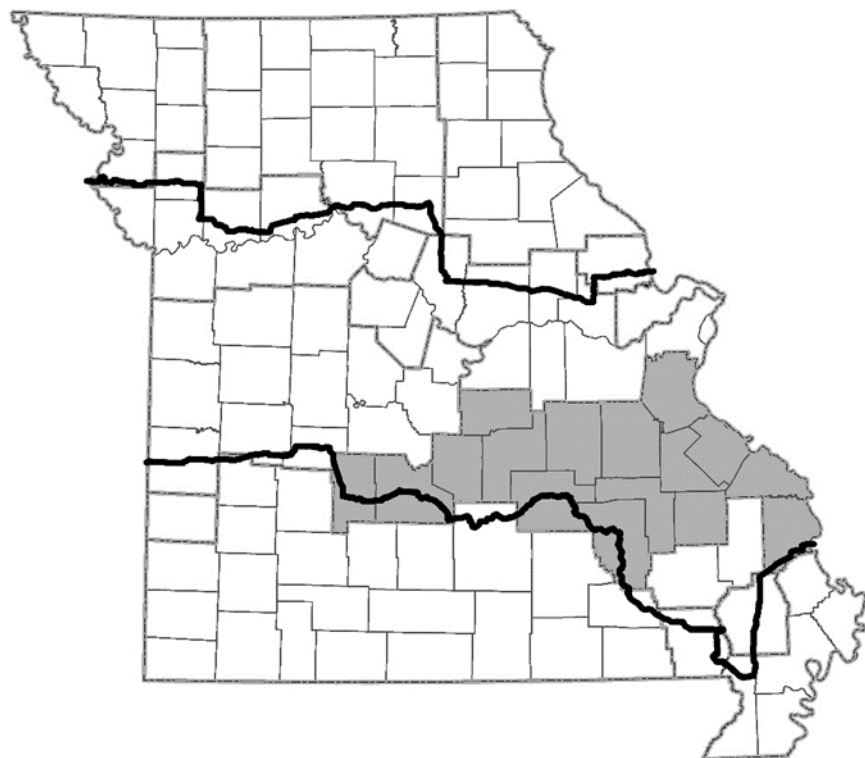
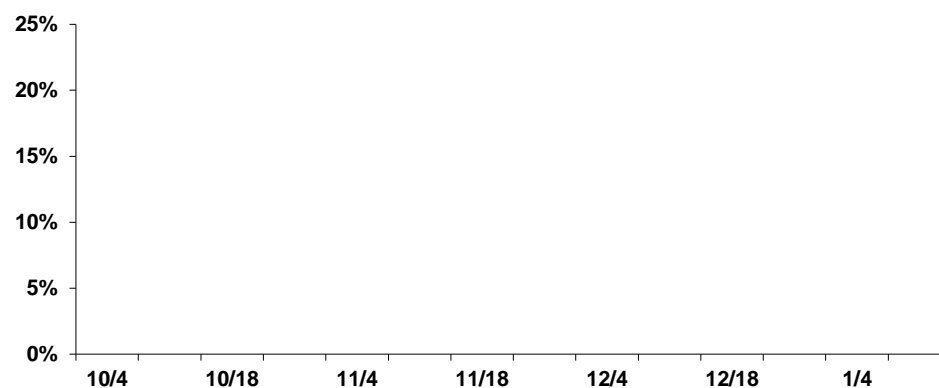


**No intensively managed wetland area located in the East Central region.
No available data on ice conditions.**

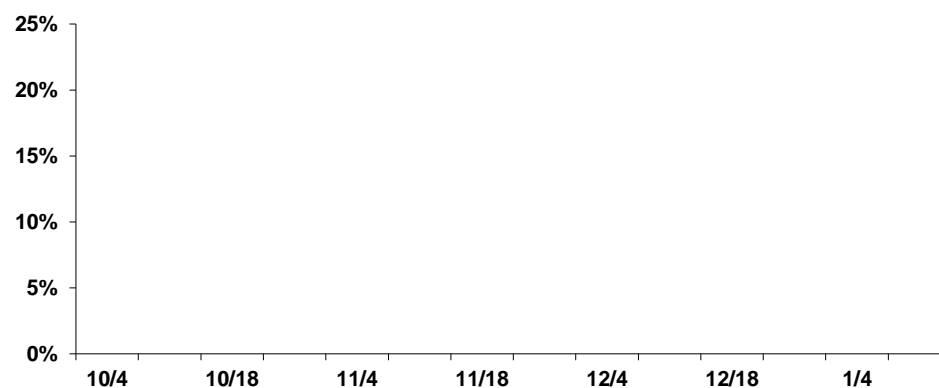


East Central Migration Timing: There are no managed wetland areas in this region so no population data are available. The lack of managed areas and suitable duck habitat limits sustained duck use throughout the area.

No intensively managed wetland area located in the East Central region.

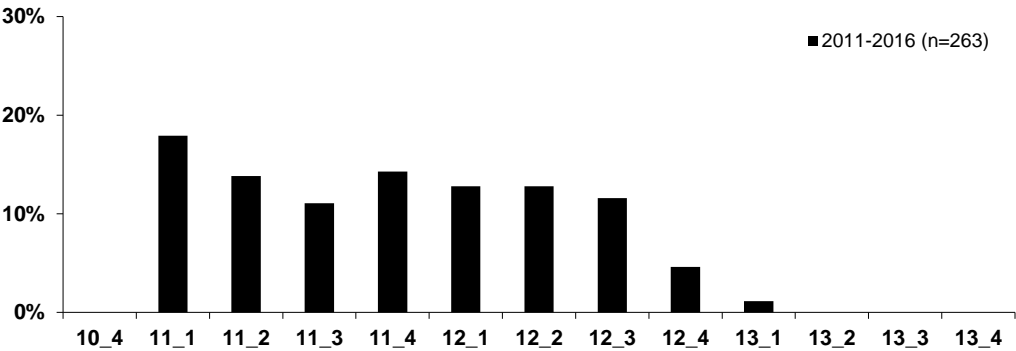


No intensively managed wetland area located in the East Central region.

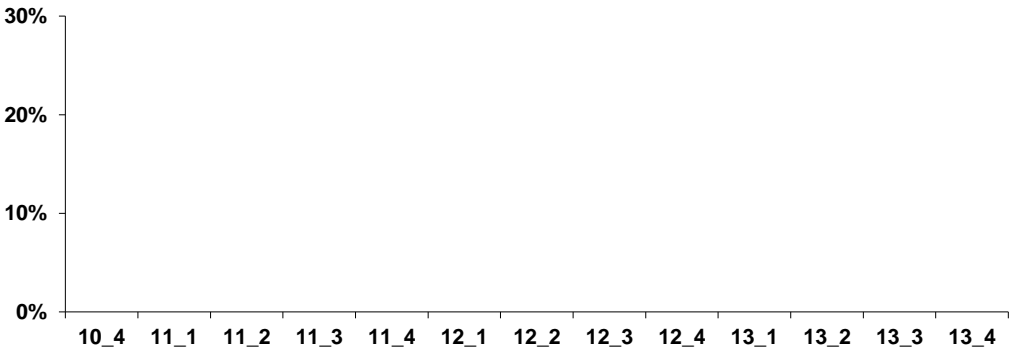


East Central Harvest: This region accounted for about 1% of the statewide FWS harvest estimate and 1% of statewide mallard band recoveries during 2011-2016. Harvest is likely limited to wood ducks and early season migrants during the early season with some mallards later in the season. In 2011-2016, 32% of the total daily average occurred during the first two weeks in November and 6% occurred in the last week of December and first week of January. Mallard band recoveries suggests a peak in mallard harvest occurs in mid- to late December (lower left chart); however, this is based on a sample size of 11.

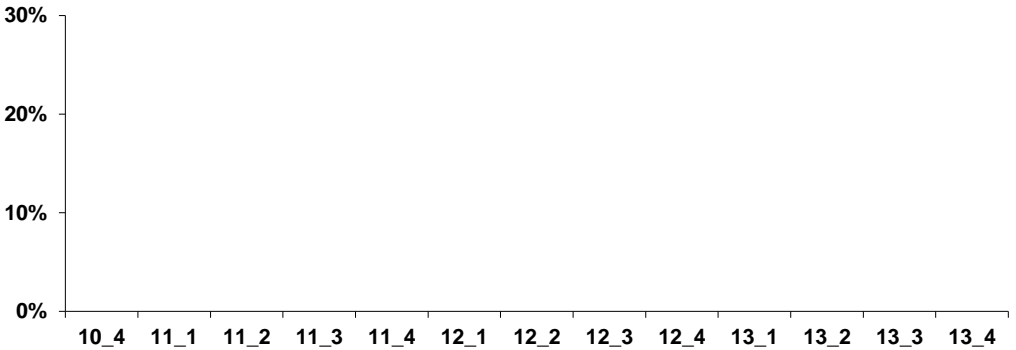
Percent average daily duck harvest per week on public and private ground in the East Central Region (FWS data).



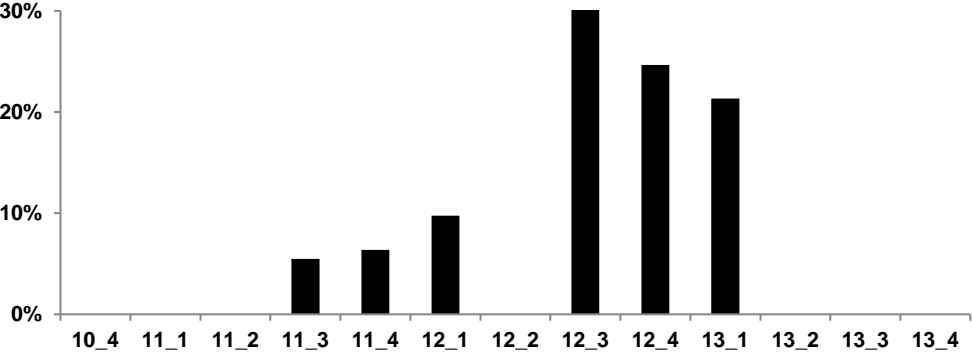
No intensively managed wetland area located in the East Central Region.



No intensively managed wetland area located in the East Central Region.



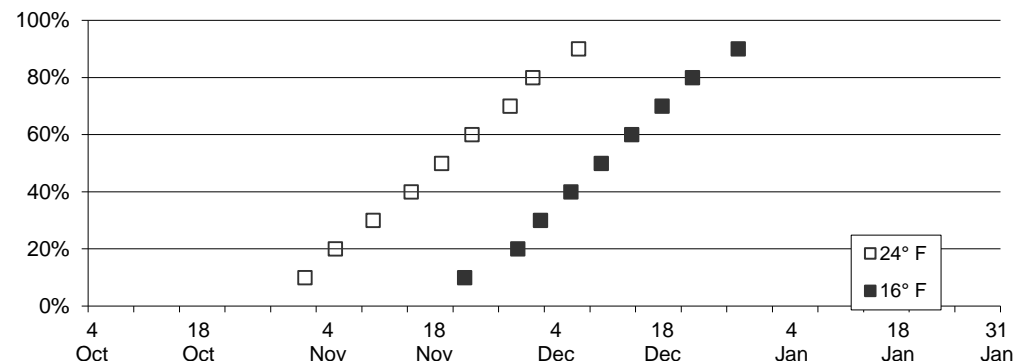
Percent average daily mallard band recoveries per week in the East Central Region: 2011-2016 (n=11).



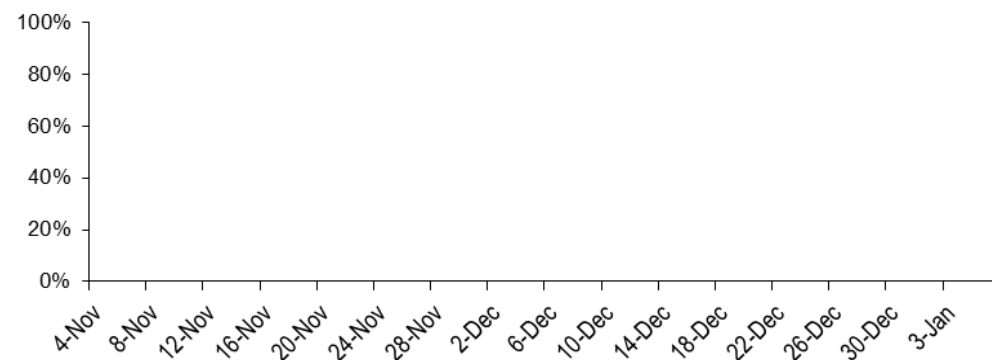
Barton Region

Barton Region Weather: Higher mean precipitation is sustained later into the fall in west central Missouri than in north Missouri and average low temperatures occur a few days later. There is a 50% probability of seeing a temperature as low as 24° F by November 19, and 16° F by December 10 (top chart). No intensively managed wetland areas are located in this region so there is no available date on ice conditions.

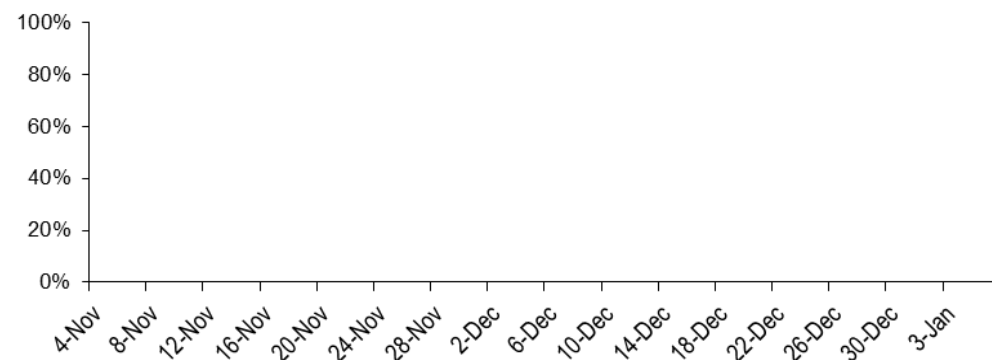
Probability (%) that a temperature of 24° F and 16° F will be reached by a certain date at Lamar, MO.



**No intensively managed wetland area located in Barton Region.
No available data on ice conditions.**

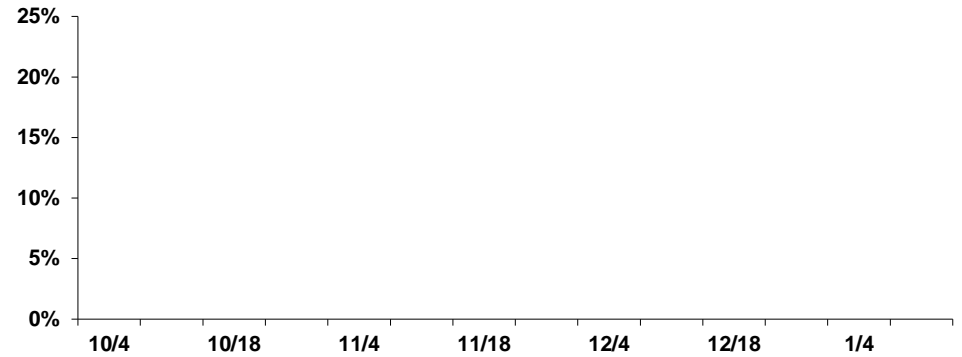


**No intensively managed wetland area located in Barton Region.
No available data on ice conditions.**

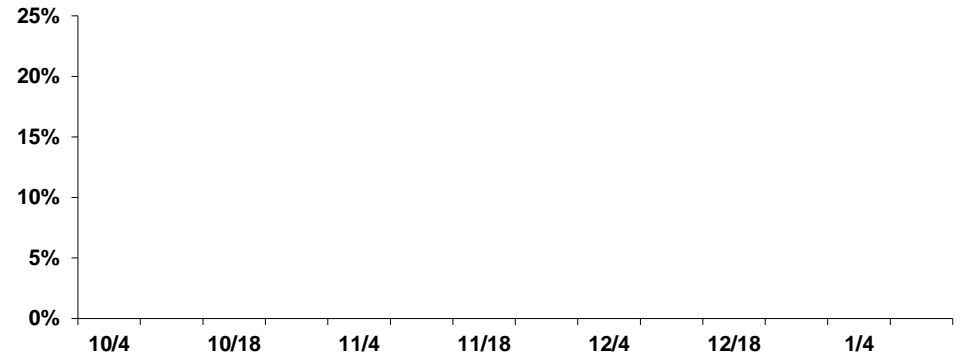


Barton Region Migration Timing: There are no managed wetland areas in this region so no population data are available.

**No intensively managed wetland area located in the Barton Region.
No available data on duck use.**

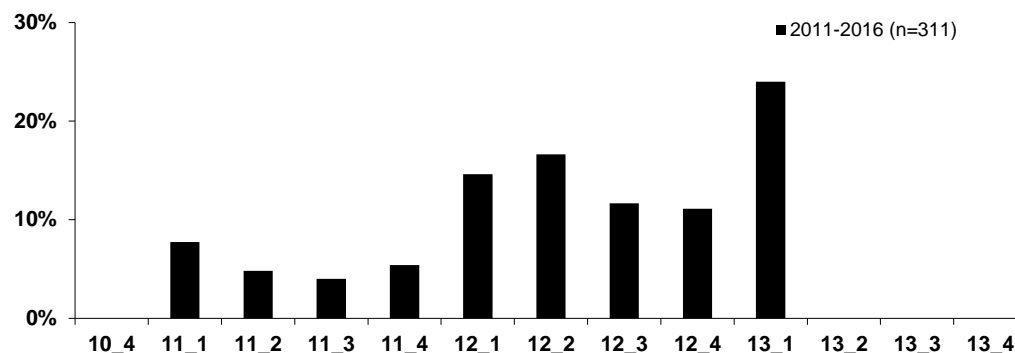


**No intensively managed wetland area located in the Barton Region.
No available data on mallard and early dabbling duck use.**

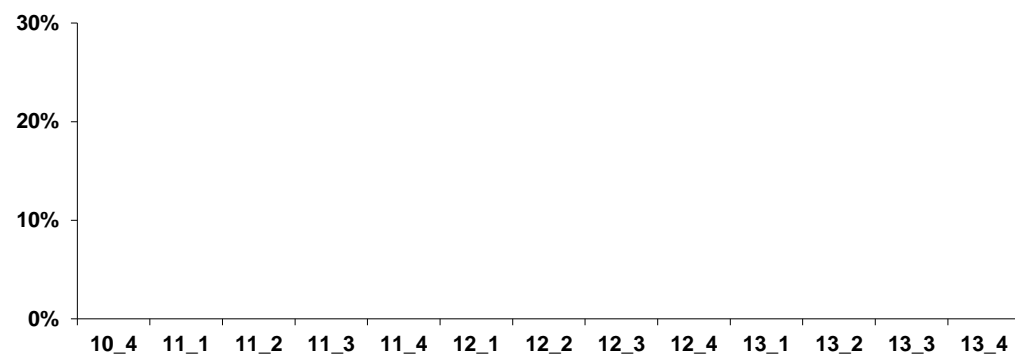


Barton Harvest: This region accounted for about 1% of the statewide FWS harvest estimate and 1% of statewide mallard band recoveries from 2011-2016. During 2011-2016, approximately half of this region was in the Middle Zone and opened the first week of November and half was in the South Zone and opened on Thanksgiving Day. In 2017-2018, the entire region was in the South Zone opening on Thanksgiving Day, experienced a split after the first four days of the season and closed the last week of January. Excluding opening weekends, 24% of the harvest from 2011-2016 occurred during the first week of January (top chart). This peak was likely driven by harvest of a combination of mallards and other duck species. Approximately 25% of the mallard band recoveries occurred in the fourth week of November and the fourth week of December suggesting a peak in harvest during late November and late December (bottom left chart). Insufficient harvest data exists to speculate on the effect on harvest of moving the region to the South Zone in 2017-2018.

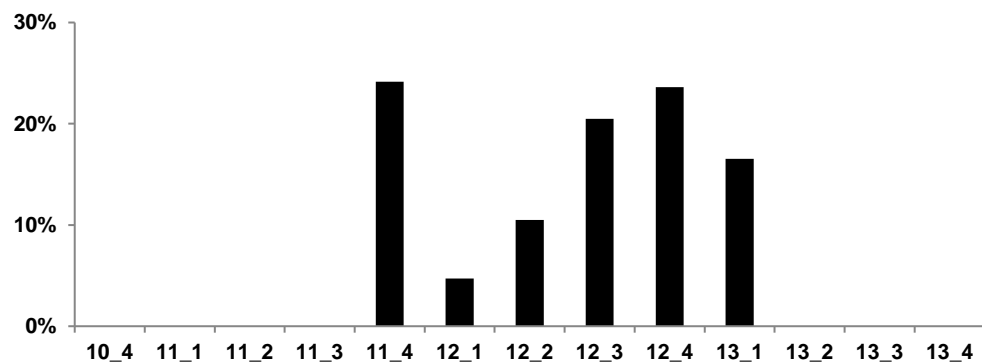
Percent average daily duck harvest per week on public and private ground in the Barton Region (FWS data).



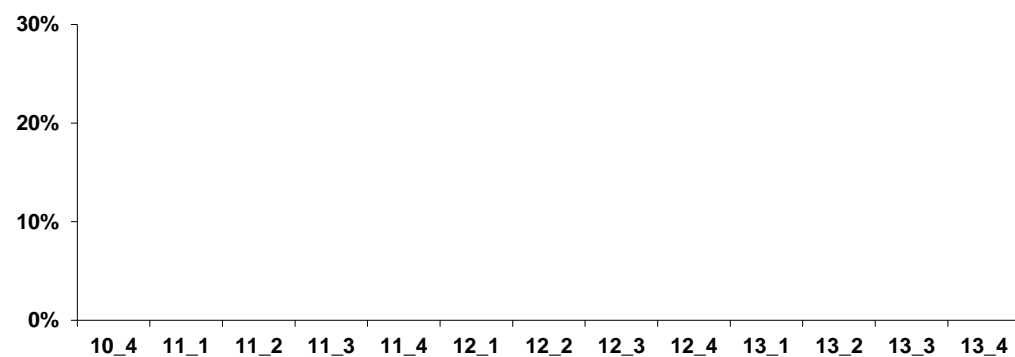
No intensively managed wetland area located in the Barton Region.



Percent average daily mallard band recoveries per week in the Barton Region: 2011-2016 (n=11).



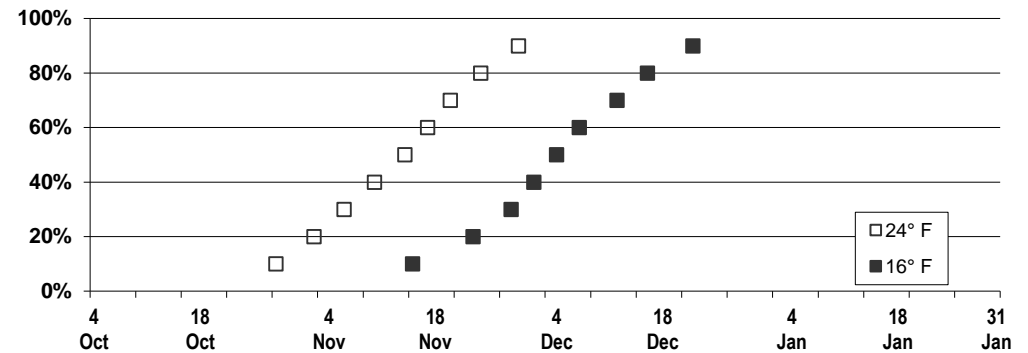
No intensively managed wetland area located in the Barton Region.



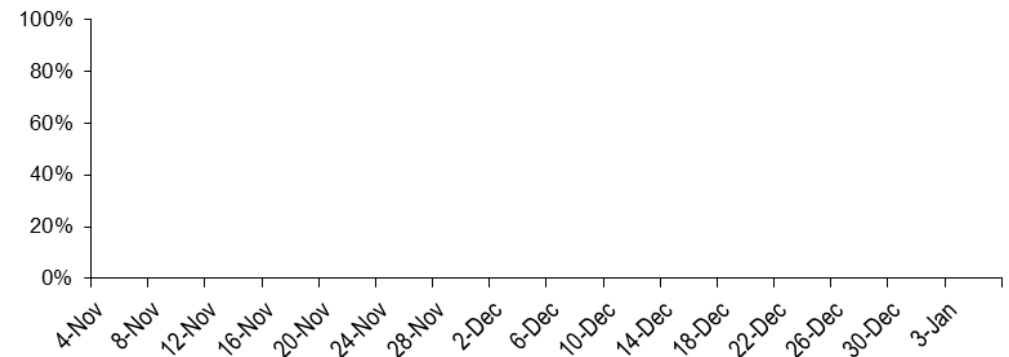
South

South Weather: Average precipitation declines in this area from early fall through winter. There is a 50% probability of the temperature falling as low as 24° F by November 14 and dropping to 16° F by December 4 (top chart). No intensively managed wetland areas are located in this region so there is no available data on ice conditions.

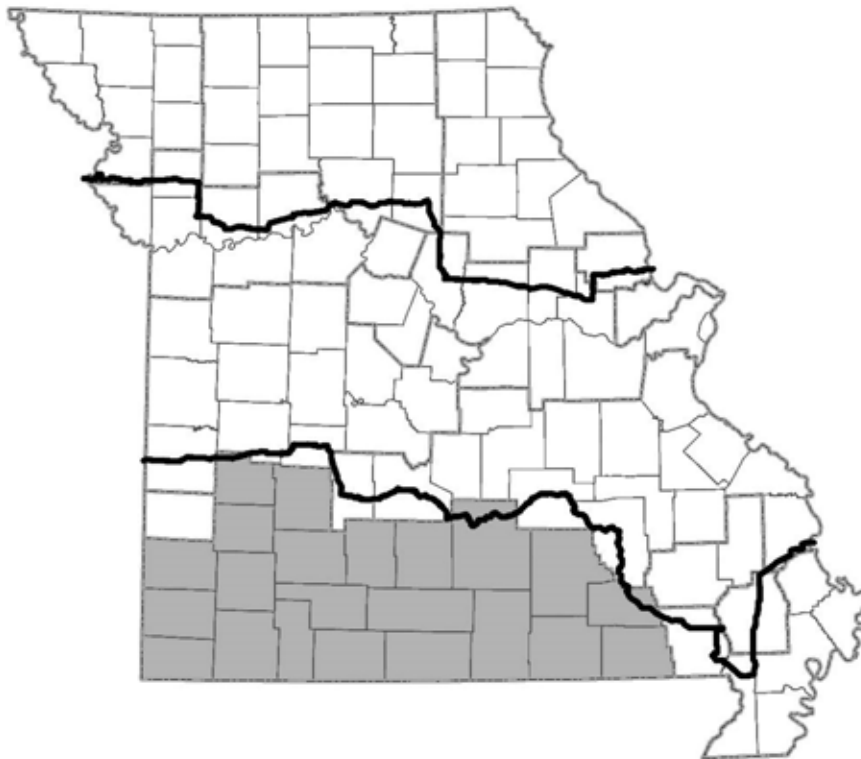
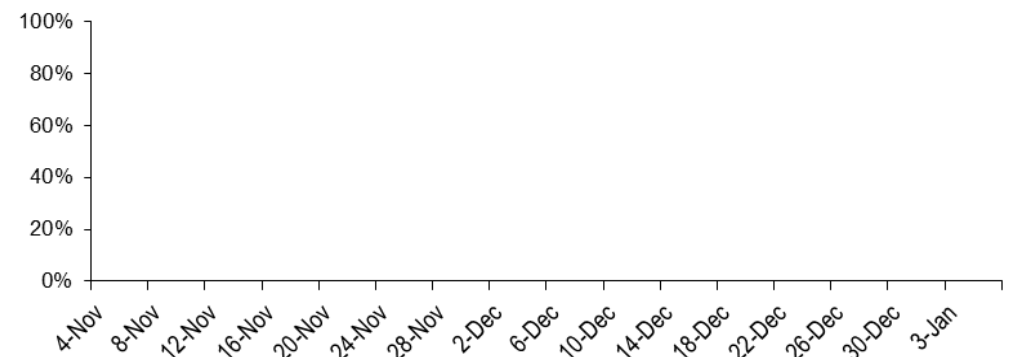
Probability (%) that a temperature of 24° F and 16° F will be reached by date at Springfield, MO.



**No intensively managed wetland area located in South Region.
No available data on ice conditions.**

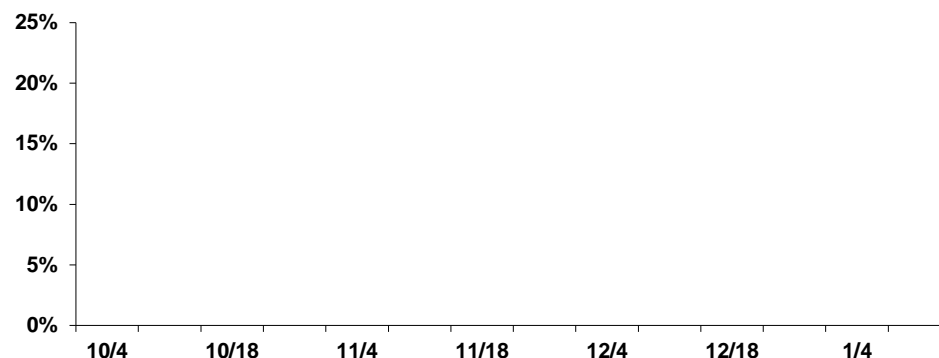


**No intensively managed wetland area located in South Region.
No available data on ice conditions.**

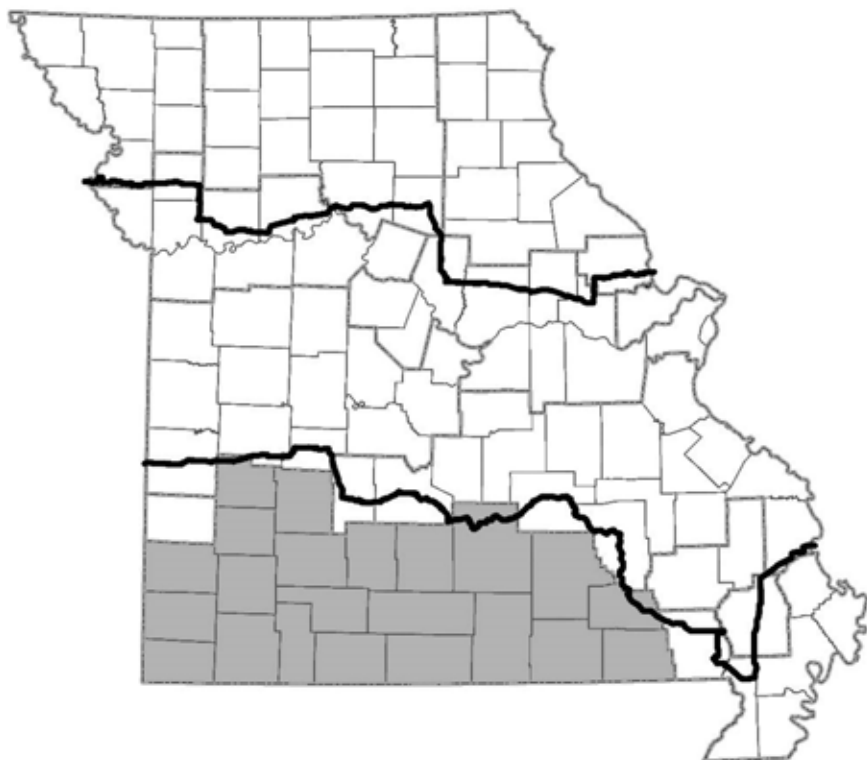
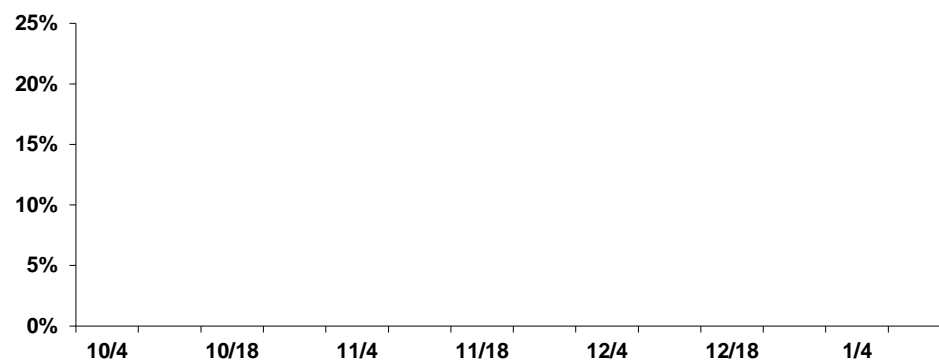


South Migration Timing: No long-term migration or population data are available for this portion of Missouri. Shallow water wetlands are found mostly in prairie areas (north and western parts) of this area. Otherwise deep reservoirs, irrigation lakes and rivers provide habitat for ducks. Populations of ducks, mallards in particular, remain well into the winter as long as open water and food are available. This region, with its abundant large reservoirs, often supports an early flight of diving ducks.

No intensively managed wetland area located in the South Region.

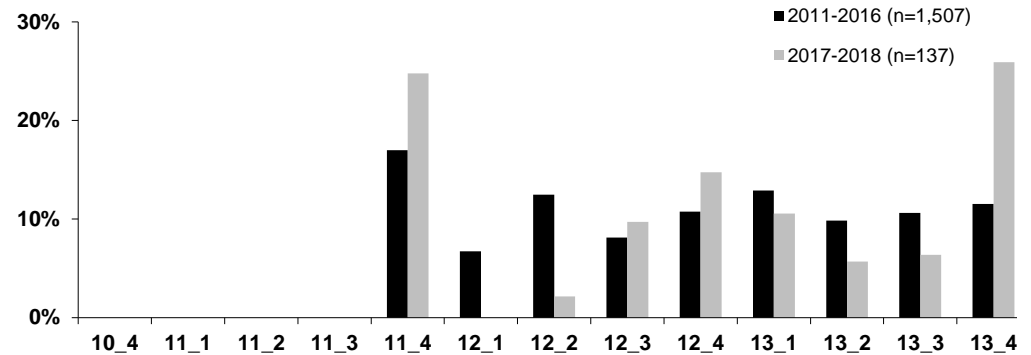


No intensively managed wetland area located in the South Region.

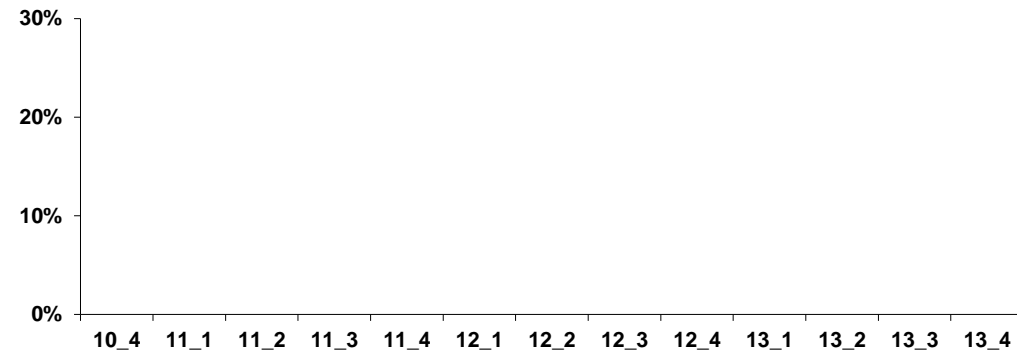


South Harvest: South Missouri accounted for 5% and 5% of the statewide FWS harvest estimate in 2011-2016 and 2017-2018, respectively, and 4% of statewide mallard band recoveries during 2011-2016. During 2011-2016, excluding opening weekends, FWS harvest estimates suggests peak harvest occurs in late November followed by relatively steady harvest during remaining weeks in the season (top chart). A similar pattern was experienced in 2017-2018 except a second, and highest, peak occurred the fourth week of January. Band recoveries suggest relatively consistent harvest of mallards throughout the season (bottom chart).

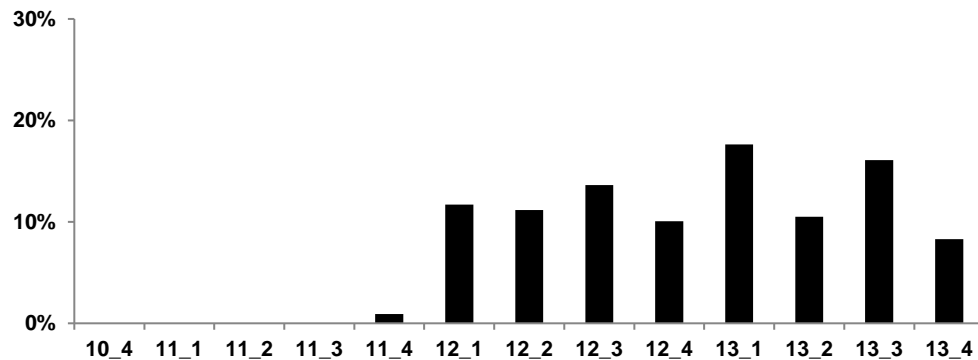
Percent average daily duck harvest per week on public and private ground in the South Region (FWS data).



No intensively managed wetland area located in the South Region.



Percent average daily mallard band recoveries per week in the South Region: 2011-2016 (n=76).



No intensively managed wetland area located in the South Region.

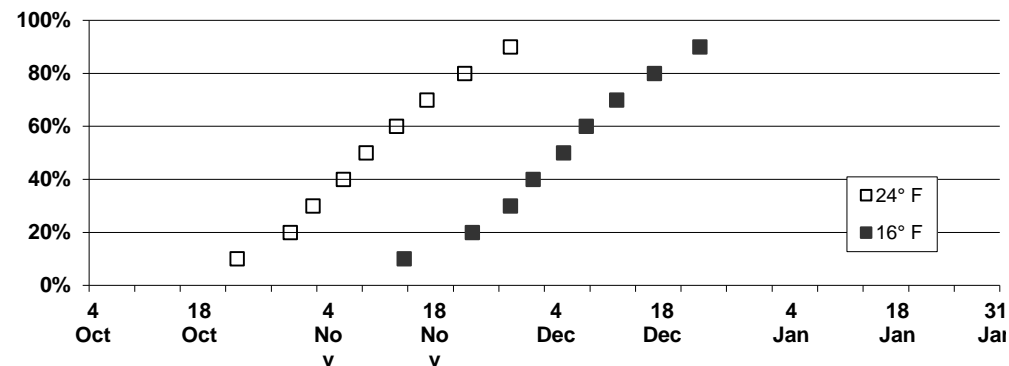


Southeast

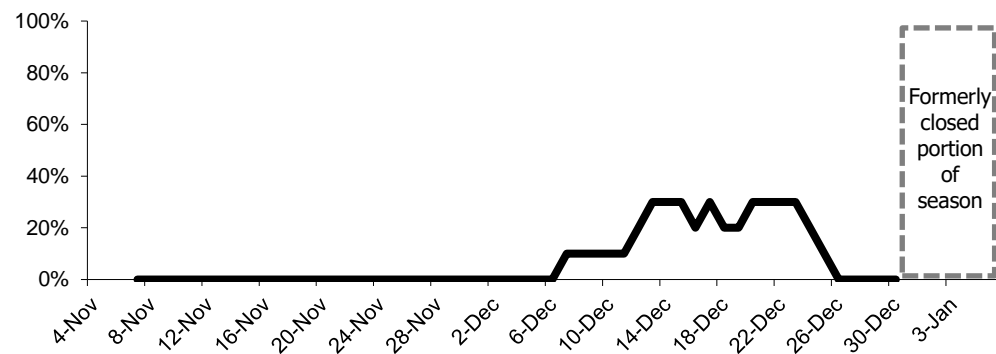
Southeast Weather: Dry conditions normally prevail through early fall. Late fall rains can provide more shallow water habitat and flood bottomland forests. The arrival of colder temperatures in the Southeast Region is roughly three weeks earlier than in the Bootheel Region. There is a 90% probability of seeing a temperature as low as 16°F by December 23 in the Southeast Region (Marble Hill weather station) and by January 17 in Bootheel Region (Malden weather station, top chart, go to page 67 for Bootheel temperature charts). Duck Creek CA has had ice two or more inches thick on December 13 during 30% of the ten-year period 2007-2016 (middle chart). During this period, Duck Creek CA has been ice-covered for an average of five days per season and, similarly, the area was ice-covered during an average of 3.5 days during the 2017 and 2018 seasons (bottom chart).



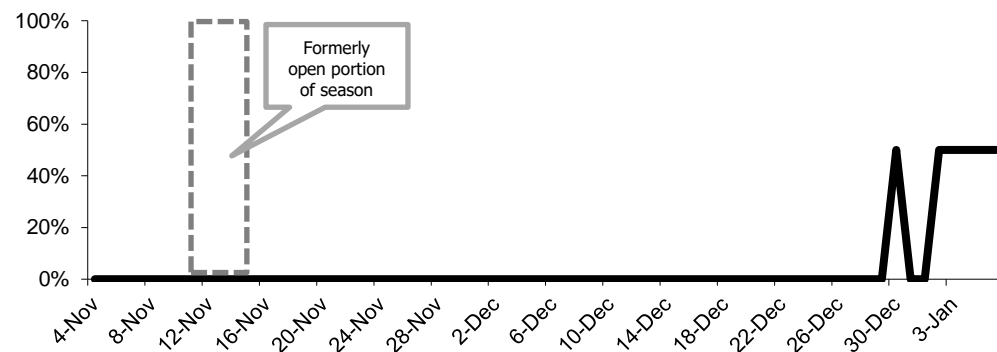
Probability (%) that a temperature of 24° F and 16° F will be reached by date at Marble Hill, MO.



Percent of years Duck Creek CA had ice > 2 inches throughout the season during the period 2007-2016. The dashed rectangle highlights portion of season closed prior to 2017.

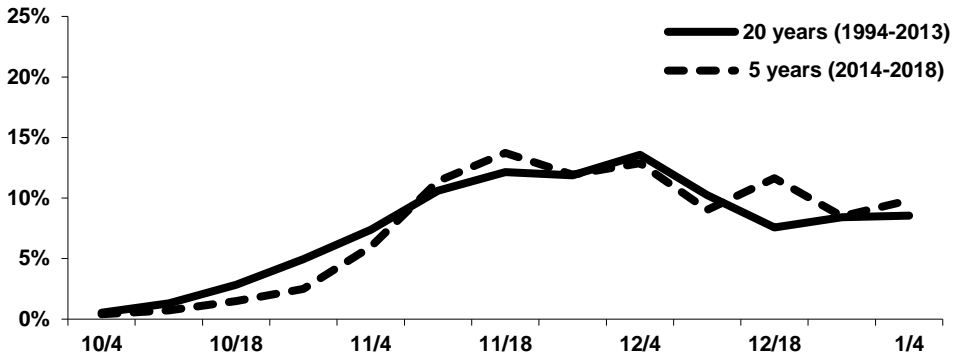


Percent of years Duck Creek CA had ice > 2 inches during 2017 & 2018 seasons. The dashed rectangle highlights split employed in 2017 and 2018 seasons.

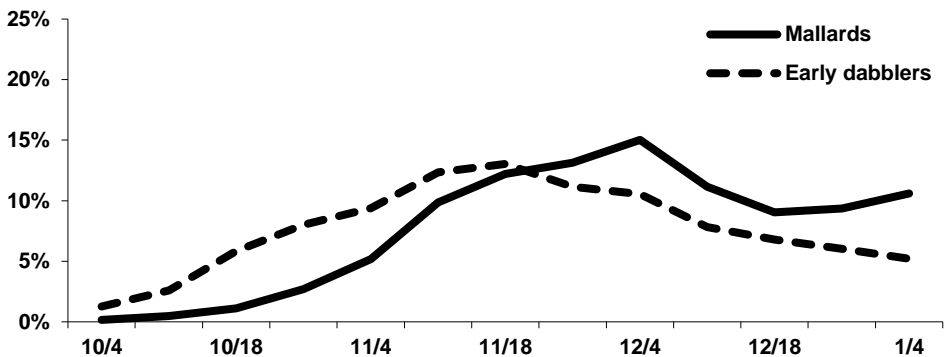


Southeast Migration Timing: Duck numbers at Duck Creek CA and Mingo NWR build steadily through November and peak during the first week in December and then decline very gradually in mid-December (top chart). In the last five years, ducks have tended to arrive later in October and early November than during the previous 20 years; however, peak numbers appear to occur on a similar timeframe among the two periods. Early season migrants reach peak numbers in early to mid-November (middle chart). Mallard use increases steadily throughout November and peaks in early December.

Percent of duck use by week (Duck Creek CA and Mingo NWR): 20- year average and 5-year average.

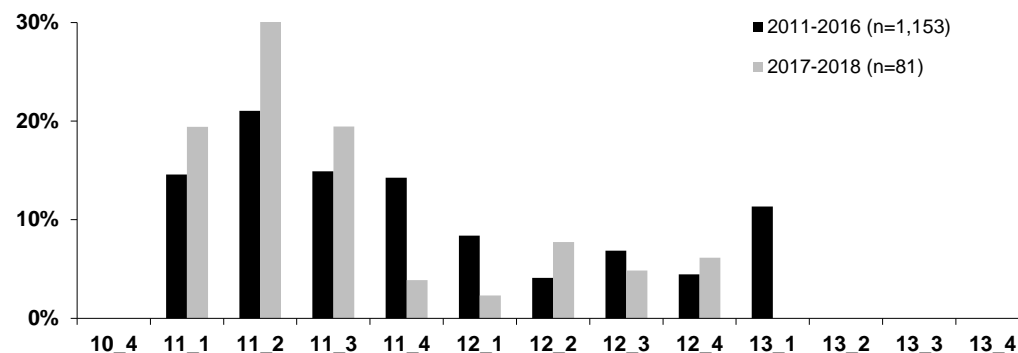


Percent of mallard and early migrant use by week (Duck Creek CA and Mingo NWR): 25-year average.

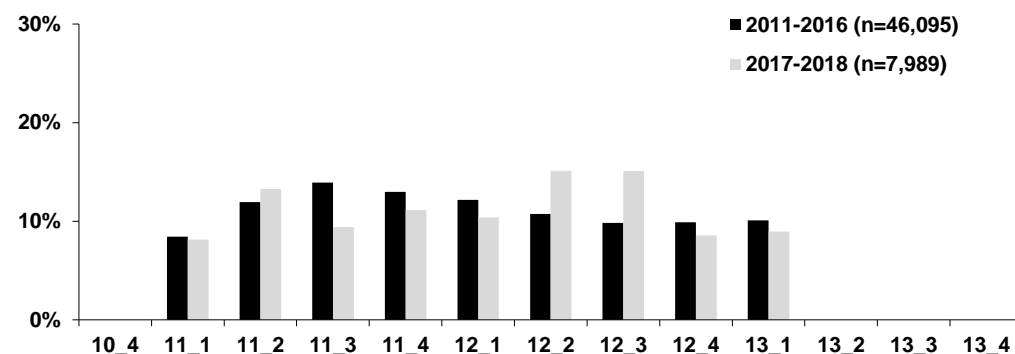


Southeast Harvest: During 2011-2016, excluding opening weekends, FWS estimates of average daily harvest on public and private wetlands indicate harvest peaked the second week in November at 21%, held at around 15% of total during the third and fourth weeks of November and then steadily declined through December with a slight bump back to 11% of total occurring the first week of January. A much higher portion of the harvest occurred in November (65% in 2011-2016 vs. 79%, 2017-2108) than in December (24% in 2011-2016 vs. 21% in 2017-18). Harvest at Duck Creek CA was relatively constant during 2011-2016 with a slight peak occurring the third week of November at 14% of total harvest (middle chart). Harvest in 2017-2018 at Duck Creek, excluding opening weekends and the first day of the second segment, was also fairly consistent throughout the season with the highest harvest occurring during the second and third week of December. Approximately 46% of ducks other than mallards are harvested during the first three weeks of November whereas mallard harvest at Duck Creek occurs throughout the season with a slight peak occurring the first week of December (bottom right chart). Mallard band recoveries suggest mallard harvest peaks in mid-November (bottom left chart).

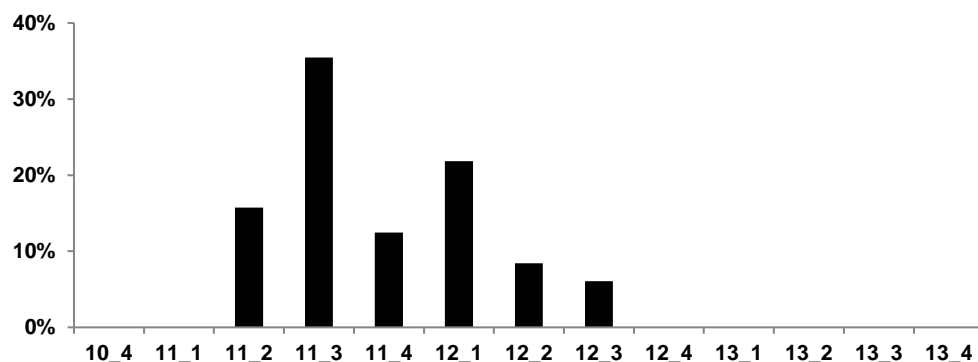
Percent average daily duck harvest per week on public and private ground in the Southeast Region (FWS data).



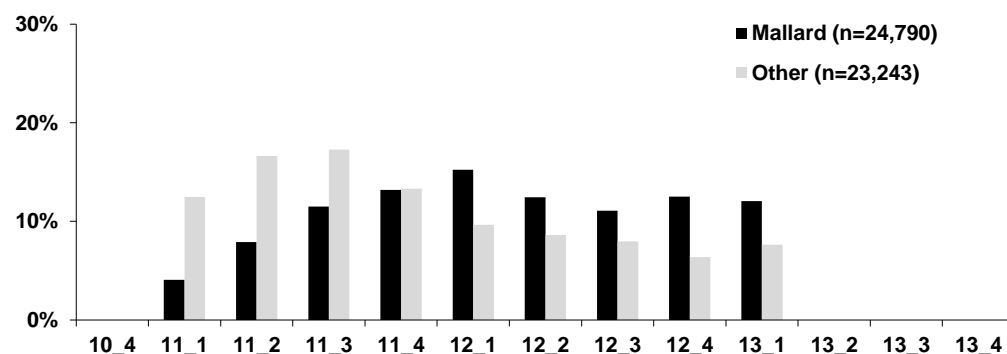
Percent average daily duck harvest per week at Duck Creek CA.



Percent average daily mallard band recoveries per week in the Southeast Region: 2011-2016 (n=18).



Percent average daily harvest per week of mallards and other ducks at Duck Creek CA: 2011-2016.

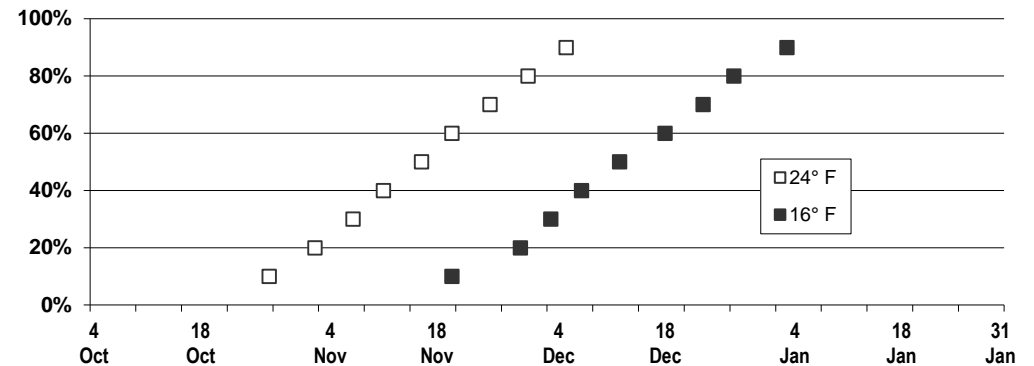


Stoddard

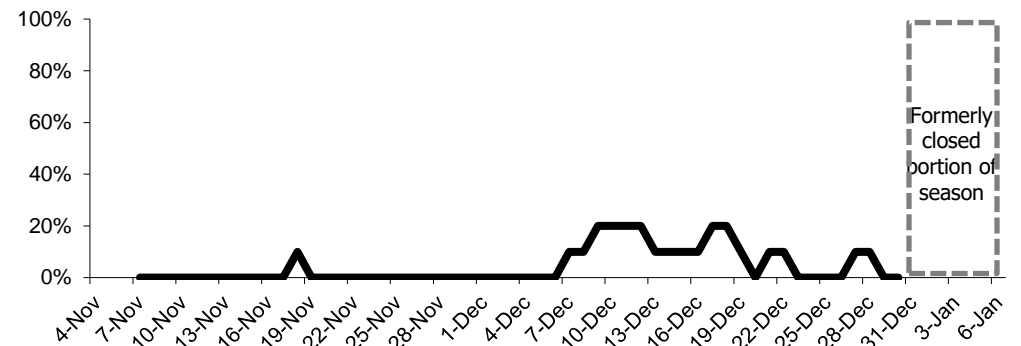
Stoddard Weather: Dry conditions normally prevail through early fall and then precipitation increases from November through December. The arrival of colder temperatures in the Stoddard Region is roughly two weeks earlier than in the Bootheel Region. There is a 90% probability of seeing a temperature as low as 16°F by January 3 in Stoddard Region (Advance weather station) and by January 17 in Bootheel Region (Malden weather station, top chart, go to page 67 for Bootheel temperature charts). Ice conditions at Otter Slough CA have prevailed most often in mid-December, but even then, it has only happened 10% of the years during 2007-2016 (middle chart). However, Otter Slough was frozen during the last 10 days of the 2017 season whereas no days were lost to ice in 2018 (bottom chart).



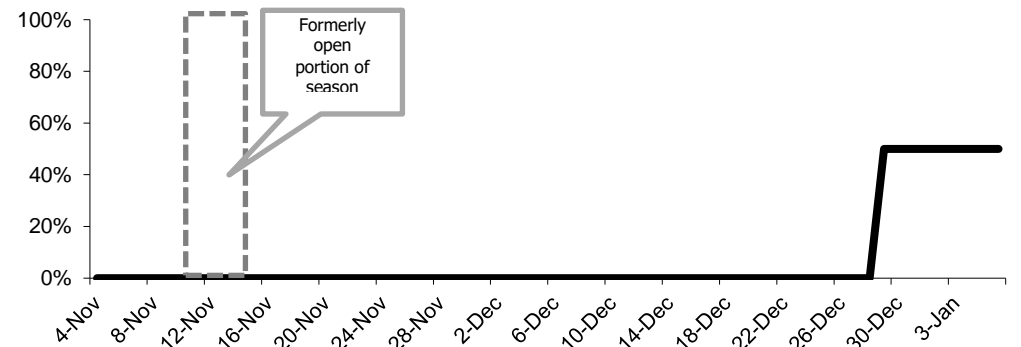
Probability (%) that a temperature of 24° F and 16° F will be reached by date at Advance, MO.



Percent of years Otter Slough CA had ice > 2 inches throughout the season during the period 2007-2016. The dashed rectangle highlights portion of season closed prior to 2017.

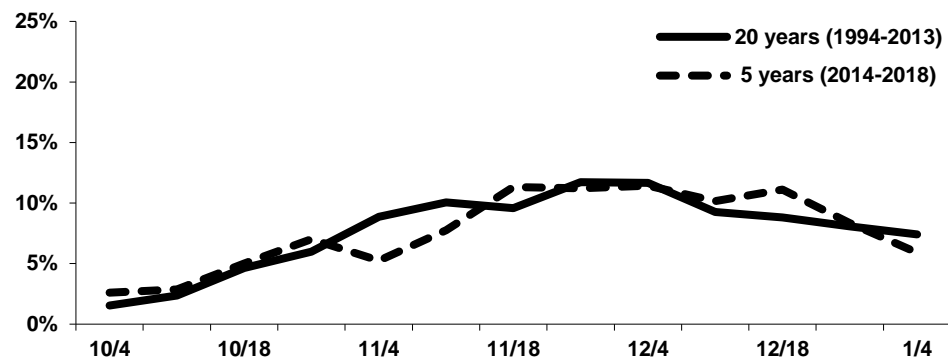


Percent of years Otter Slough CA had ice > 2 inches during 2017 & 2018 seasons. The dashed rectangle highlights split employed during 2017 and 2018 seasons.

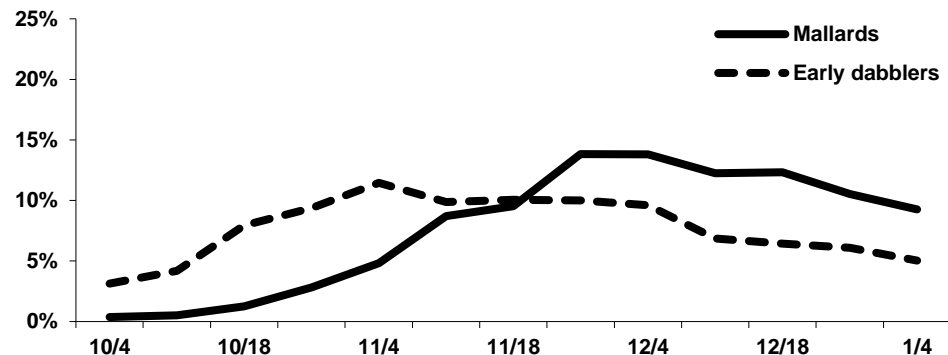


Stoddard Migration Timing: In contrast to regions in north Missouri where numbers increase and then decline fairly rapidly, ducks in this region are present for a much more extended period of time (top chart). Migration events in late October and early November contribute to increasing numbers. Early migrants peak in early November and then decline throughout the remainder of the season (middle chart). Mallard use climbs steadily through November, peaks in early December and remains relatively consistent throughout the remainder of the season.

Percent of duck use by week (Otter Slough CA):
20- year average and 5-year average.

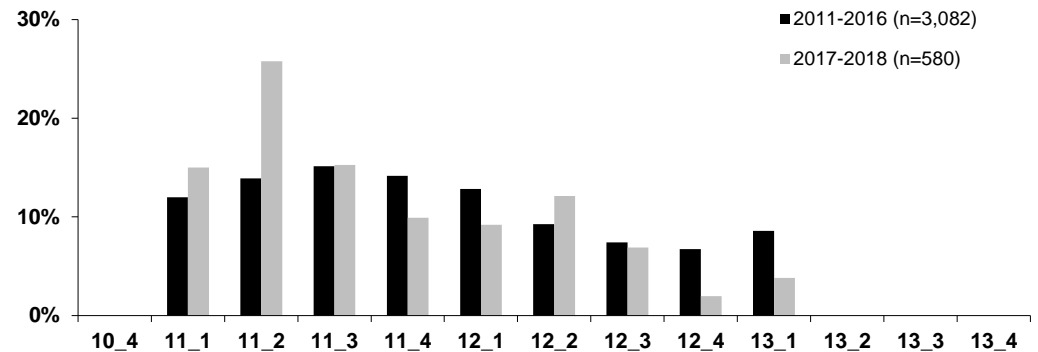


Percent of mallard and early migrant use by week (Otter Slough CA):
25-year average.

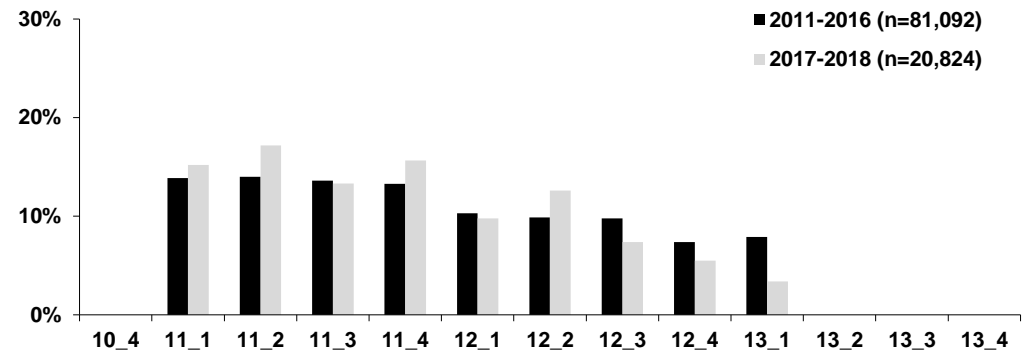


Stoddard Harvest: U.S. Fish and Wildlife harvest data includes reports from Middle and South Zone portions of Stoddard County. This data set included few records after the first week in January, so we include only Middle Zone data. Similarly, few band recoveries were from the South Zone portion of Stoddard County, so we included them in Bootheel Region. During 2011-2016, excluding opening weekends, approximately 41% of the average daily harvest on public and private ground occurred during the first three weeks of November and 23% occurred during the last two weeks of December and the first week of January (top chart). In 2017-2018, excluding opening weekends and the first day of the second segment, 56% of harvest occurred during the first three weeks November and 13% occurred during the last two weeks of December and first week of January. Harvest at Otter Slough CA was relatively constant during both the 2011-2016 and 2017-2018 with slightly higher harvest in November than during December or January. Harvest for mallards at Otter Slough gradually increases through November and then declines through December; other species peak in early November and then decline thereafter (bottom right chart). Mallard band recoveries suggest a similar pattern although a second, slight peak occurs the fourth week of December and first week in January (bottom left chart).

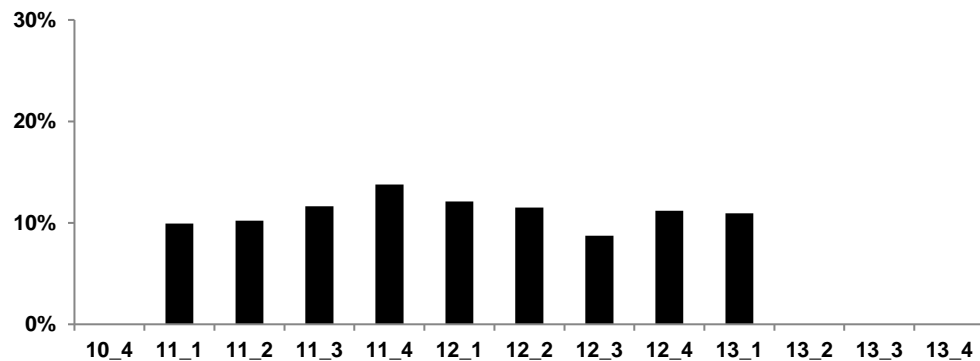
Percent average daily duck harvest per week on public and private ground in the Stoddard Region (FWS data).



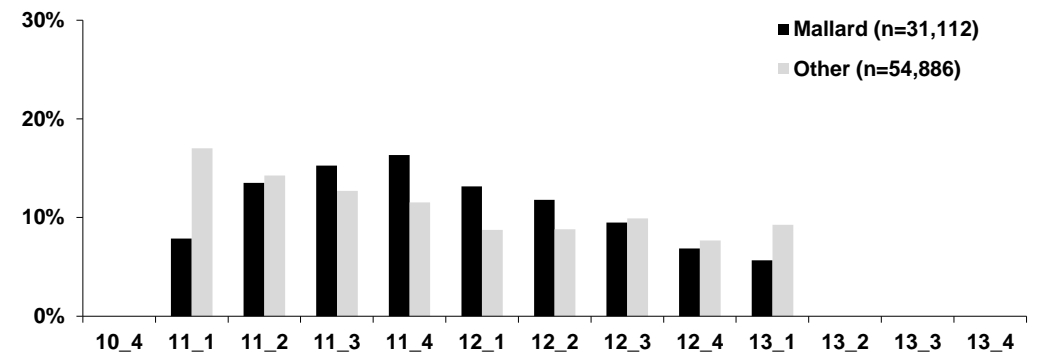
Percent average daily duck harvest per week at Otter Slough CA.



Percent average daily mallard band recoveries per week in the Stoddard Region: 2011-2016 (n=185).



Percent average daily harvest per week of mallards and other ducks at Otter Slough CA: 2011-2016.

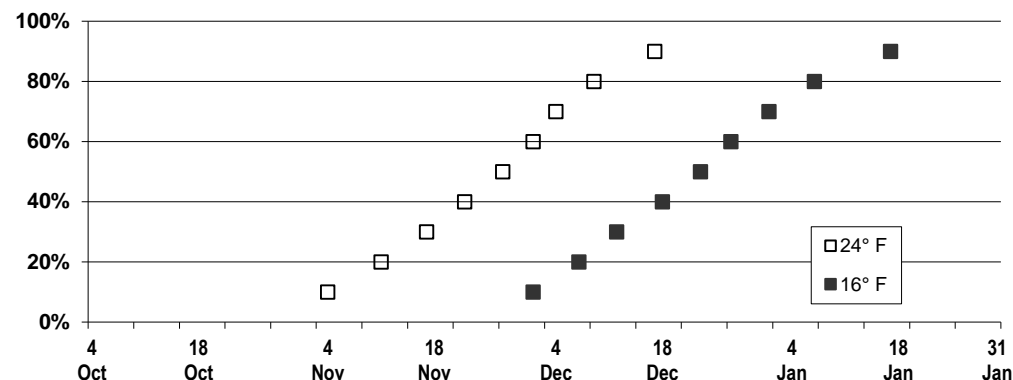


Bootheel

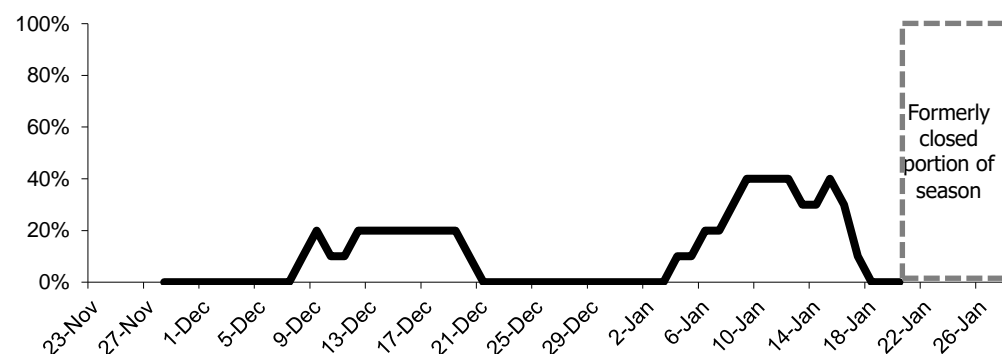
Bootheel Weather: Rainfall typically increases in November and December and creates additional habitat for migrating and wintering ducks (top chart). The arrival of colder temperatures in the Bootheel Region is roughly two weeks later than in the Stoddard Region. There is a 50% probability of seeing a temperature as low as 24°F by November 16 in the Stoddard Region (Advance weather station) and by November 27 in the Bootheel Region (Malden weather station). These two locations do not have a 90% chance of experiencing 16°F temperatures until January 3 and January 17, respectively. Ten Mile Pond CA has had thick ice about 30% of the time in mid-January from 2007-2016 (middle chart). Wetlands at Ten Mile Pond CA have been ice-covered for an average of seven days each year over these ten seasons. In contrast, the area experienced 19 days of ice in 2017 but lost zero days to ice in 2018 (bottom chart).



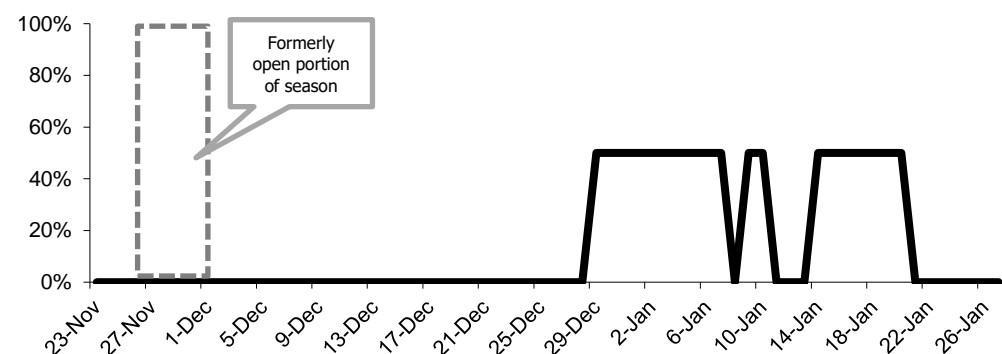
Probability (%) that a temperature of 24° F and 16° F will be reached by date at Malden, MO.



Percent of years Ten Mile Pond CA had ice > 2 inches throughout the season during the period 2007-2016. The dashed rectangle highlights portion of season closed prior to 2017.

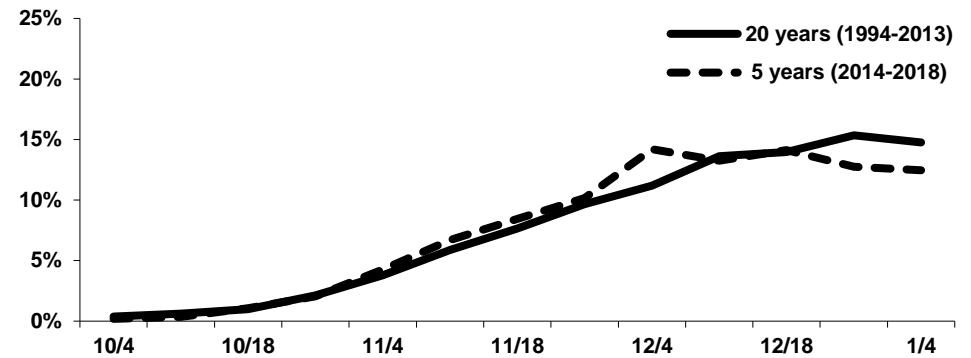


Percent of years Ten Mile Pond CA had ice > 2 inches during 2017 & 2018 seasons. The dashed rectangle highlights split employed in 2017 & 2018 seasons.

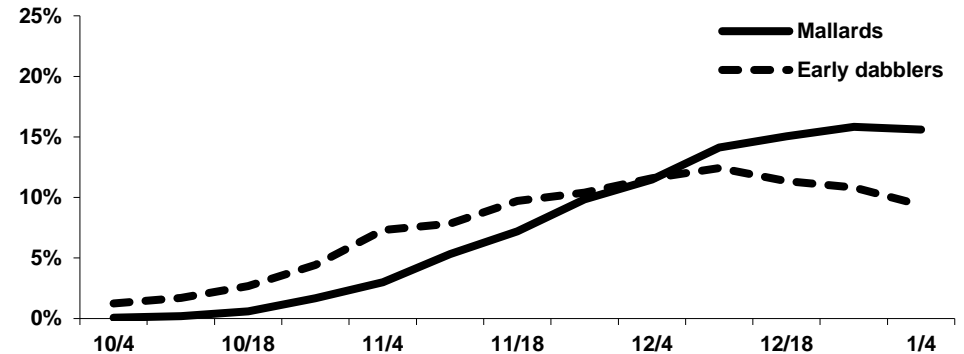


Bootheel Migration Timing: Duck use patterns in this region differ from most other regions in Missouri. Late fall and early winter rainfall create “increasing” food availability in wetlands and freeze-up, if it occurs at all, is of short duration. If forced to leave, ducks often move only a short distance and may return within a few days. The comparison of 20-year and 5-year data is truncated due to lack of long-term information extending through January (top chart). Peak use occurs during December and through mid-January. Early dabbler use is relatively steady through December with mallard use peaking in January (middle chart).

**Percent of duck use by week (Ten Mile Pond CA):
20- year average and 5-year average.**

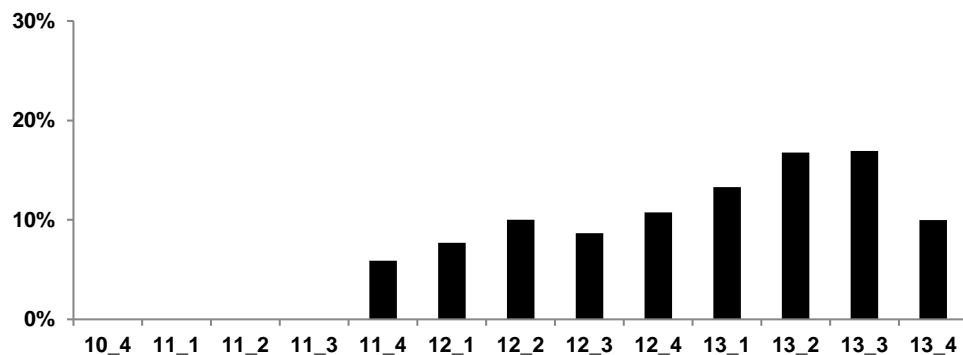


**Percent of mallard and early migrant use by week (Ten Mile Pond CA):
20-year average.**

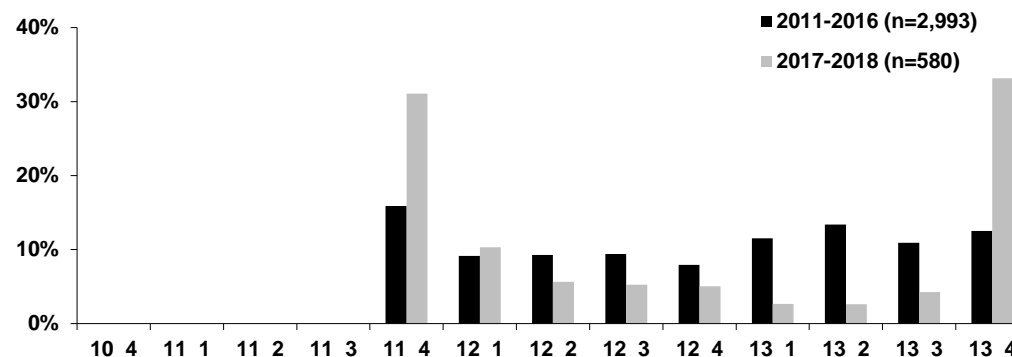


Bootheel Harvest: Compared to other regions of Missouri, the Bootheel typically exhibits relatively consistent hunting from the start through the end of season; however, the season opens after many early season migrants have departed Missouri. During 2011-2016, excluding opening weekends, harvest peaked the fourth week of November, declined slightly and was relatively consistent through December, experienced a slight bump in early January and then declined slightly the last two weeks of January (top chart). In 2017-2018, excluding opening weekends and the first day of the second segment, harvest peaked the first week of the season (fourth week in November) and then steadily declined until a second peak that occurred the last week of the season (fourth week of January). Harvest at Ten Mile Pond CA shows a similar pattern in both periods with relatively steady harvest throughout the 2011-2016 season whereas, in 2017-2018, peaks in harvest occurred early in the season (fourth week of November/first week of December) and late in the season (fourth week of January). Compared to other regions, there is little difference in the timing of mallard harvest compared to other species (bottom right chart). Mallard band recoveries suggests a peak of harvest occurs in mid-January (bottom left chart).

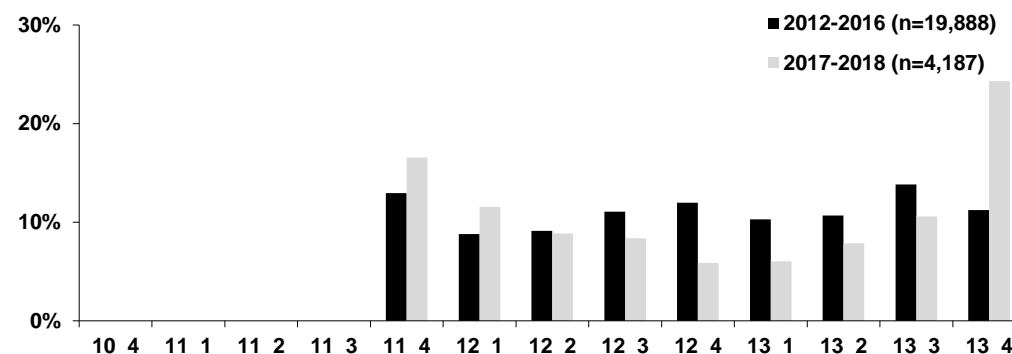
Percent average daily mallard band recoveries per week in the Bootheel Region: 2011-2016 (n=287).



Percent average daily duck harvest per week on public and private ground in the Bootheel Region (FWS data).



Percent average daily duck harvest per week at Ten Mile Pond CA.



Percent average daily harvest per week of mallards and other ducks at Ten Mile Pond CA: 2011-2016.

